The occurrence of such a variation as this gives much food for thought, especially to those who are interested in the question as to whether species are ever developed by spasmodic or discontinuous variation. It is evident that under conditions of light or colour-surroundings favourable to an animal like the normal Tayra, black with a yellow breast-spot, the same patch on the upper surface might also prove effective, and that individuals possessing it might gradually crowd out the normal coloured examples. In this way, however spasmodically produced in the first place, the abnormal colouring might become the mark of a peculiar race or species. That this has not as yet taken place, however, is shown by the normal examples taken with the others already referred to.

It would also have to be remembered that the Tayra, like so many similarly coloured animals, is arboreal in its habits, and that if it often crawls along, back downwards, underneath boughs, a similar reason for breaking up the mass of the body-colour might obtain as with the breast-spot in the normal position. The curious yellow spot in the middle of the back in male specimens of *Bradypus* offers a suggestive parallel to the coloration of these abnormal Tayras.

In addition the Tayra of the Island of Trinidad has become so very much smaller than that of the mainland that it also seems to deserve a peculiar subspecific name, and may be called

4. *Galictis barbara trinitatis*, subsp. n.

Size much smaller than in *G. b. typica*; skull of male 101 millim. in basal length by 67 in greatest breadth, of female 92 by 60. Colours as in the typical form.

Hab. Trinidad. Type from the Caroni district.

Type (female) B.M. no. 99. 2. 2. 1. Presented by Henry Caracciolo, Esq.

XVII.—*New South-American Mammals.*

By Oldfield Thomas.

Canis sechuræ, sp. n.

Allied in essential characters of skull and dentition to *C. griseus*, Gray, and *C. gracilis*, Burm., but very different externally.

Fur short, coarse and harsh, quite unlike the soft fur of the allied species, the hairs of the back barely 30 millim. in length. General colour of upper surface coarsely grizzled iron-grey, with a slight fulvous tinge; each of the longer hairs of the back is light-coloured for its proximal third, black for the middle third, the terminal third being white or

fulvous white proximally and black terminally; the basal part of the hair being hidden in the underfur, the visible portion of the hairs may be said to be black with a whitish subterminal ring. Underfur scanty, dull greyish proximally, dull fulvous terminally. Face clearer grey, very different to the rufous face of the allied species; muzzle blackish; narrow ring round eyes rufous brown; whole of outer surface of ears and a triangular patch behind their posterior bases bright rufous. Upper lip white, clouded with brown opposite the roots of the whiskers; a narrow line of rufous edging its junction with the grey of the face. Tip of chin white; interramia more or less darkened, but not, as in the allied species, broadly black to the level of the angles of the mouth. Centre line of throat dull white, terminated by a grizzled grey band across the chest. Belly fulvous white; the hairs pale fulvous to their bases, gradually becoming white mesially and in the inguinal region. Fore limbs grizzled grey proximally in front, fulvous terminally and on their inner surfaces. Hind limbs nearly all fulvous, darker behind and on the soles, lighter above and in front; no blackish marking above the heels. Tail slender, coarse-haired, coloured like the back, but more heavily blackened; gland-patch and terminal tuft fairly well marked, but not so conspicuous as in *griseus* and *gracilis*.

Skull practically identical with that of the Chilla, but perhaps slightly smaller on the average, and with rather lower bullæ. In the dentition the carnassial, both above and below, is slightly smaller and the grinding-teeth larger than in the allied forms.

Dimensions of the type (a male, measured in the flesh by collector):—

Head and body 580 millim.; tail 300; hind foot (s. u.) 120; ear 60.

Skulls.

	No. 464. ♂, aged.	455. ♂, adult.	456. ♂, adult.	448. ♂ (type), yg. adult.	460. ♀.	500. ♀.
Extreme length	123	120	118	114	113	107
Basal length	114	111	109	..	..	99
Greatest breadth	68	61·5	61	59	57	57
Length of nasals	38	38	38	36	35	34
Interorbital breadth	24	21·5	20	20·5	20	22
Intertemporal breadth	24	22	21	24·5	23	25
Breadth of brain-case	44	41·5	41·5	41	39	41
Palate length from henselion	60	58	57	57	55	53
Teeth:—						
Upper carnassial, outer length.	10·6	10·1	9·8	10·4	10	10
Combined length of $m.^1$ and $m.^2$	13·4	13	13	13·3	13·1	12·5
Greatest diameter of $m.^1$	..	..	10·6	11	10·5	10·8
Lower carnassial, length	11·6	12	11·7	12·5	11·7	11·5
$M._1$ and $m._2$ combined	..	10·8	9·4	10	10·1	10·5

Hab. Desert of Sechura, N.W. Peru. Type from Sullana; other examples from Amotape and Catacaos.

Type (male). Original number 448. Collected 12th July, 1899, by Mr. Perry O. Simons. Five skins and six skulls examined.

This fox is clearly a northern representative of *C. griseus* and *gracilis* (which are doubtfully different from each other), but is interestingly modified for a desert life. In this modification it has taken on a considerable resemblance to the Old-World jackals, just as the desert-mouse described below resembles the desert-gerbilles of Africa and Asia. As a species it may be readily distinguished from its allies by its short coarse fur, scanty underfur, grey instead of rufous head, bright rufous ears, less blackened chin, more fulvous belly, and other details.

As usual in describing specimens relating to Chilian animals, I have been much indebted to the excellent material contributed to the British Museum by Mr. J. A. Wolffsohn, of Valparaiso, and it is by the help of his specimens of the "Chilla" that I have been able to make out the relationship of this interesting Peruvian fox.

Sciurus stramineus guayanus, subsp. n.

Mr. Simons has sent from Sapotillo and other places to the north of the Sechura Desert a series of a squirrel answering precisely to the description of *S. Nebouxii* *, Is. Geoff., and showing that instead of being an individual variation of *S. stramineus*, as had been supposed by Alston, that form, which is characterized by a prominent white nuchal patch, is at least locally constant. The type specimen was obtained at Paita, perhaps sent down from the interior.

On the other hand, the typical specimens of *Macroxus Fraseri*, Gray, from "Ecuador," agree fairly well with the original figure of *S. stramineus*, Eyd. & Soul., and may be considered to represent the typical form of that species.

Compared with these two subspecies, the squirrel found west of Guayaquil seems to form a third definable race, for which I would suggest the above name, and would describe as follows:—

No white nuchal patch.

General colour of back grey, the hairs tipped with white as in *Nebouxii*, quite unlike the dark colour of *typicus*; rump and base of tail orange-rufous; nose white; face brown, finely sprinkled with yellowish; ears grizzled brown and

* References to all the names here quoted are given by Alston, P. Z. S. 1878, p. 664.

white. Arms and legs like back; wrists and ankles rufous; hands and feet blackish. Under surface dark brown, the chest and middle line of belly prominently grizzled with whitish. Tail, as usual, broadly washed with white.

Dimensions of the type (measured in skin) :—

Head and body 270 millim.; tail 310; hind foot (wet) 57; ear (wet) 26.

Hab. of type, Balzar Mountains, on the Upper Palenque River, W. Ecuador. Another specimen from Chongon (*Simons*).

Type (male). B.M. no. 80. 5. 6. 81. Collected by Mr. Illingworth.

The three races now recognized may be briefly distinguished as follows :—

S. stramineus typicus.—General colour dark; no nuchal patch. Under surface dark brown.

S. s. Nebouxii.—General colour light; a nuchal patch. Under surface pale grey.

S. s. guayanus.—General colour pale; no nuchal patch. Under surface brown, grey mesially.

Phyllotis gerbillus, sp. n.

A small species, not unlike a *Peromyscus* in general proportions, with typical desert-coloration, such as is found in many Gerbilles; quite unlike any Neotropical species hitherto described.

Size rather larger than in *Mus musculus*. Fur soft, sleek and shiny, the hairs about 5–6 millim. long on the back. General colour of head and back clear sandy fawn, rather variable in tone, but on the whole very similar to that of the Egyptian *Gerbillus gerbillus*. Individually the hairs are slaty at their bases, then whitish, with their visible ends fawn, finely tipped with blackish. Ears proportionally large, pale grey. Under surface wholly pure white, the line of demarcation fairly well marked, and so high that the white includes the whole of the limbs, fore and hind, from the shoulders and hips downwards, the fawn not extending on to the limbs at all. Tail fairly well haired, faintly pencilled, wholly white, or the median line above slightly darker.

Skull practically a miniature of that of *Ph. Haggardi*, but the zygomata rather more widely expanded.

Dimensions of the type (measured in the flesh by collector) :—

Head and body 82 millim.; tail 90; hind foot (s. u.) 20; ear 17.

Skull: greatest length 24; basilar length 18; zygomatic

breadth 12·3; nasal length 9·5; interorbital breadth 4; palate length from henselion 10; diastema 6; palatal foramina 5·6; length of upper molar series 3·5.

Hab. Piura, N.W. Peru, alt. 50 m. Other specimens from Catacaos.

Type (female). Original number 496. Collected 12th April, 1899, by Mr. Perry O. Simons. Several specimens examined.

The nearest ally of this striking little mouse is *Phyllotis Haggardi*, which is half as large again and of a general grey colour.

The present is the first record of true desert-coloration in South America, and even in the desert-regions of western North America the only specimens at all approaching *Phyllotis gerbillus* that I have seen are some of the paler examples of *Peromyscus Gambeli*.

Rhipidomys venustus, sp. n.

Of about the same size as *Rh. venezuelæ*, with which it occurs, but distinguished by its slate-mixed belly, more bushy tail, darker coloration, and slightly different skull.

Fur thick and close, not very long, the hairs of the back about 8 millim. in length. General colour above rufous fulvous, of a much deeper tone than in *Rh. venezuelæ*, the head and fore-quarters more fulvous, the posterior back darker and more rufous. Sides with a brighter rufous edging to the belly. Under surface from chin to anus slaty white, the basal halves of the hairs slaty, their tips dull white, line of demarcation on sides not sharply defined. Eyes without darker rings round them. Ears fairly well-haired, dark brown, darker than in the allied species. Hands dull white above, with a slight metacarpal darkening; feet with these colour-contrasts more strongly marked, back of heel dark brown, and a decided patch of dark brown on the terminal part of the metatarsus; proximal part and sides of metatarsus and upper surface of toes yellowish white. Tail long, well-haired, pencilled at tip, the terminal hairs 12–15 millim. in length, uniformly dark brown throughout.

Skull with a narrower interorbital space than in *Rh. venezuelæ*. Nasals also narrowing more rapidly behind, their breadth at about half their length being about 2·5 millim., as compared to 3·0 or 3·2.

Dimensions of the type (measured in skin) :—

Head and body 121 millim.; tail 151; hind foot (s. u.) 24·8.

Skull: greatest length 33·5; basilar length 26; greatest breadth 18·2; nasals 12 × 3·7; interorbital breadth 4·3;

brain-case 17·5 × 13·5; palate length from henselion 13·1; diastema 8·7; palatal foramina 6·6 × 2·5; length of upper molar series 5.

Hab. Merida. Type from "Las Vegas del Chama," alt. 1400 m.

Type (female). B.M. no. 99. 12. 1. 1. Collected 14th July, 1896, by S. Briceño.

Three skins of this species have been lying for some time among Sr. Briceño's specimens of *Rh. venezuelæ*, to which I had supposed them to be referable. Now, however, a closer examination shows that they belong to quite a different species, distinguished by the characters above mentioned.

NEACOMYS, gen. nov.

Type. Oryzomys spinosus, Thos. P. Z. S. 1882, p. 105.

Further knowledge of South-American Muridæ having failed to reveal any species of "*Oryzomys*" intermediate between the *Acomys*-like "*Hesperomys*" *spinosus* described by me eighteen years ago and the ordinary soft-furred species of *Oryzomys*, I now think it advisable to give that anomalous form a special generic name.

To the cranial characters described previously it may be added that the skull is low and broad, the supraorbital edges distinctly but not excessively beaded, the interparietal of medium size, the bullæ small, and the palatal foramina are unusually short. The molars are of typical *Oryzomys* structure, but are small in proportion to the general size of the skull.

Neacomys spinosus tenuipes, subsp. n.

Very similar to *N. s. typicus* in general appearance, spininess, and colour, but the general tone rather less vivid, the back darker, and the sides shading off into fulvous rather than rufous. Belly-hairs pure white or dull white, not slate-based, though this latter characteristic proves to vary in *N. s. typicus*. Feet very much smaller than in *typicus*, averaging about 2 millim. shorter, and very markedly more slender than in that form.

Dimensions of the type (an adult female, measured in skin):—

Head and body 76 millim.; tail 93; hind foot 20; ear 12.

Hab. Guaquimay, near Bogota. Also from "Quebrada negra" and "Magdalena Valley."

Type. B.M. no. 99. 10. 3. 74. Collected by G. D. Child, 16th January, 1896. Five specimens examined.

Five specimens of the typical form from Peru have the hind feet 22·2, 22·2, 22·4, 22·6, and 23 millim.; the longest foot among the Bogota series is 20·5 millim. in length.

BIBLIOGRAPHICAL NOTICES.

Rhopalocera Æthiopica. Die Tagfalter des Æthiopischen Faunengebietes. Eine systematisch-geographische Studie. Von Chr. Aurivillius. Mit 6 Tafeln. *Der Königl. Akademie der Wissenschaften vorgelegt den 8 Juni* 1898. (*Kongl. Svenska Vetenskaps-Akademiens Handlingar*, Bandet 31, No. 5.) Stockholm, 1898 (correctly, 1899). Pp. 561.

Die Lepidopterenfauna des Bismarck-Archipels. Von Dr. Arnold Pagenstecher. Erster Theil: *Die Tagfalter.* Mit 2 color. Tafeln. (*Zoologica*, Heft 27.) Stuttgart, 1899. Pp. 160.

Orthopteren des Malayischen Archipels, gesammelt von Prof. Dr. W. Kükenthal *in den Jahren* 1893 *und* 1894, *bearbeitet von* Brunner von Wattenwyl, *unter Berücksichtigung neuer verwandter Species.* Mit fünf Tafeln. (*Abhandl. d. Senckenbergischen naturforschenden Gesellschaft*, Band xxiv. Heft 2.) Frankfort-on-Main, 1898. Pp. 193–288.

A prominent feature of learned Transactions and other Continental scientific publications in quarto is the encouragement which they offer to the issue of large and important works on Entomology, which would otherwise perhaps never see the light, and which are often accompanied with more fitting illustrations than would be possible on octavo plates, which are frequently too small to represent large insects properly. We have grouped three such publications together in the present notice.

Sweden has always been prominent in the study of African Lepidoptera. Many species from North, West, and South Africa are described in Linné's 'Systema Naturæ'; and the papers by Wallengren and Zeller on the species collected by Wahlberg in Caffraria, and published just about the time when Mr. Trimen first went out to the Cape, may be said to have inaugurated a new era in our studies. And now Prof. Aurivillius has given us a synopsis of the butterflies of the whole of Æthiopic Africa and Madagascar, numbering at present 1612 species—a total sure to be largely increased every year, especially now that his book has rendered the determination of species so easy. The Hesperiidæ are not included, being regarded as a separate group from the more typical butterflies.

The book is published in German, as being better known to entomologists in general than Swedish. It could hardly be expected that the species, except novelties, should be described in full; we are, however, not only given synopses of families and genera, but often even of the species in the different genera, such synopses being, in most cases, sufficient for identification.

Before completing his work, Prof. Aurivillius made a tour to inspect the various collections containing African butterflies, visiting Denmark, Germany, Austria, Holland, Belgium, and England; but we regret that he does not appear to have met Mr. Trimen.

A classified list of 142 works on African Lepidoptera, arranged geographically, will be found very useful.

There is much general matter at the beginning and end of the work, including several tables of geographical distribution.

Dr. Arnold Pagenstecher, of Wiesbaden, is as well known to entomologists as his cousin is known to the outside world as an oculist; and the publication before us is an elaborate monograph of the butterflies of an interesting part of the Papuan fauna, some of the islands of which were visited by the French exploring expeditions about 60 or 70 years ago, when various butterflies were collected there. At that time, some of the islands were known as New Britain and New Ireland, but they have received other names since they came into German hands. It is not to be expected that so distant and outlying a fauna should contain many species which are also found in Europe: the only species that strikes us, on glancing through the paper, is *Plebeius bæticus*; but this is rather an outlying European representative of a tropical group than a specially European species. The present paper on the Butterflies is to be followed, later, by another on the Moths, which entomologists will doubtless look forward to with much interest.

The third work on our list relates to the Order Orthoptera, and consists of lists of species captured in Batchian, Borneo, Celebes, Halmahera (otherwise called Gilolo), Ternate, and Java, with descriptions of numerous new species; and tables are given of the species included in some of the genera. The descriptions strike us as being, in many cases, rather too short to be quite sufficient for identification; but the measurements are carefully given in all cases, and a considerable number of species are figured, sometimes the whole insect, and sometimes only a leg or pronotum. This work will be very useful to students of Orthoptera, who, however, we fear are not too numerous at present.

New Zealand Moths and Butterflies (*Macro-Lepidoptera*). By G. V. Hudson, F.E.S. (Author of 'An Elementary Manual of New Zealand Entomology'). With 13 Plates. 4to. 1898. West, Newman, & Co. Pp. xix, 144.

The Fauna of New Zealand, as might be expected from its outlying position, is comparatively poor, but extremely interesting from the number of indigenous species absolutely peculiar to the islands. As regards Lepidoptera, the first attempt to bring together the scattered information existing on the subject was made by Dr. A. G. Butler in 1874, who included an account of the order in the "Voyage of the 'Erebus' and 'Terror,'" enumerating 318 species. Of these, 132 were Macro-Lepidoptera, and are represented by 234 species in Mr. Hudson's work, the number of species detected in New Zealand having been nearly doubled by the present time. Consequently we shall probably be not very far wrong if we assume the total number of New Zealand species now known to be about 600, which at a moderate estimate we may expect may ultimately be raised to 800, or perhaps even 1000. The majority of these are moths. Of butterflies Dr. Butler enumerates 9, of which one at least is very doubtful; Mr. Hudson admits 15, and mentions 5 other reputed species, 3

being possibly indigenous and the other 2 accidentally introduced European species. Of the 15, 1 (*Anosia erippus*, Cram.) is introduced, 5 are Australian, and the remaining 9 (or 10 if *Chrysophanus Feredayi*, Bates, is distinct from *C. salustius*, Fabr.) are species absolutely peculiar to New Zealand.

There is a brief but useful introduction dealing with Metamorphosis, Anatomy, Origin of Species, Classification, and Geographical Distribution. In Classification Mr. Hudson follows Mr. Meyrick's system, of which we need only say here that it is too soon yet to predict how far its innovations are likely to be ultimately accepted by entomologists, especially as regards the propriety of placing the butterflies in the middle of the moths, instead of as a perfectly separate group. Even as regards the Hesperiidæ (which, by the way, are not represented in New Zealand) the connecting links between butterflies and moths are so few and uncertain that it appears to many entomologists that to place the butterflies in the middle of the moths is an innovation only likely to further increase the difficulties of a satisfactory classification of Lepidoptera, which has been recognized for the last century as one of the hardest problems of entomology.

All the species known to the author are figured, the original descriptions of others being copied, and full information is given about habits, localities, food-plants, distribution, &c. An Appendix by Florence W. Hudson contains a brief descriptive list of plants mentioned. The first two plates are plain, dealing with structure and neuration, the third includes coloured figures of larvæ and pupæ, and the remainder are devoted to perfect insects. The large size of the plates is a great economy in allowing a considerable number of figures to be inserted on one plate. We find as many as fifty-two figures on plate viii., which is devoted to "Notodontinæ," which all lepidopterists will recognize as Geometridæ, an innovation for which Mr. Hudson is not responsible, but which is likely, we are afraid, to remind many entomologists of an uncomplimentary expression which sometimes occurs in Euclid.

In some respects we think that Mr. Hudson should have given fuller information, especially as his book is intended for use in a country where entomological libraries cannot always be easy of access. We think the dates of all the references should have been given throughout, and not only occasionally, and the references themselves should have been fuller. It is not sufficient under *Sphinx convolvuli*, L., to quote merely *Protoparce distans*, Butl., without any clue to where the insect is described and figured, nor any remark whatever on the characters which led Koch and Butler to consider the Australian and New Zealand form of the insect distinct from the European. The references are:—

Sphinx roseofasciata, Koch, Indo-Austr. Lep. Fauna, p. 54 (1865).
Sphinx distans, Butl. Lep. N. Zealand (Voy. 'Erebus' and 'Terror'), p. 4, pl. ii. fig. 11 (1874).

There is an extraordinary error on p. 104, where *Hypolimnas bolina*, L., is placed in the genus *Anosia*, as if it was congeneric

with *A. erippus*, Cram., the two butterflies belonging to different subfamilies of the Nymphalidæ.

It is interesting to note that Mr. Hudson thinks the well-known "vegetating caterpillar" of New Zealand will prove to be that of *Porina Mairi*, Buller, and not of *Hepialus virescens*, Doubl. (We cannot understand why Mr. Meyrick and Mr. Hudson should continue to place an insect so dissimilar from the European types of *Hepialus* in the same genus.) Mr. Hudson has already pointed out ('Entomologist,' xviii. p. 36) that the larva of "*H.*" *virescens* lives in the stems of trees, and never goes beneath the ground even to pupate; and in the present work he remarks:—"The real point to be discovered is the precise species of Lepidoptera this caterpillar would develop into if not attacked by the fungus; but at present no definite information has been obtained on the subject." We do not remember that very much has been published on the "Vegetating Caterpillar" of late years, and we are sorry that Mr. Hudson has no more definite information to give us respecting it; and it is rather a pity that he has not given a detailed account of the caterpillar, accompanied with one or more figures, in the present work.

The Butterfly Book, a Popular Guide to a Knowledge of the Butterflies of North America. By W. J. Holland, Ph.D., D.D., LL.D., Chancellor of the Western District of Pennsylvania; Director of the Carnegie Museum, Pittsburgh, Pa.; Fellow of the Zoological and Entomological Societies of London; Member of the Entomological Society of France, &c. With 48 Plates in Color-photography, reproductions of Butterflies in the Author's collection, and many text-illustrations presenting most of the species found in the United States. New York: Doubleday & McClure Co., 1898; new edit. 1899. Roy. 8vo. Pp. xx, 382; col. pls. 48.

This is the first approximately complete and practical manual of the Butterflies of North America; for the older publications on the subject are necessarily both obsolete and very incomplete, and most modern books deal only with the fauna of a limited district, and are usually insufficiently illustrated, or else are so costly as to be far beyond the reach of the ordinary student. So great was the need of such a book as Dr. Holland's that many of the entomologists of the United States and Canada eagerly bought it on its first appearance, in many cases almost before it had got into the market at all; and the first edition was nearly exhausted in less than a month after publication, as if it had been a new novel by a popular author; but, we imagine, a quite unprecedented event in the history of any entomological book.

Hitherto Dr. Holland has chiefly been known to entomologists by his papers on African Lepidoptera, but he has not neglected those of his own country, and has had the good fortune to be able to form one of the most complete collections and libraries in North America relating to the subject. The present volume contains over a thousand coloured figures, a large proportion taken from the actual typical specimens, and no less than 150 species are here illustrated

in colour for the first time. With exceptions noticed below, every species of butterfly found on the continent of North America from the Gulf of Mexico to the Arctic Circle is thus illustrated. Five of the earlier plates are devoted to larvæ and pupæ.

There are also nearly 200 plain illustrations in the text, illustrating details of the earlier stages of butterflies, apparatus, neuration, &c., and *Megathymus yuccæ*. The author adds that there are about 125 other species, chiefly Hesperiidæ, which have not been mentioned; but we may take it that these are obscure and little-known species occurring in out-of-the-way parts of the country, and that, as regards all the more accessible parts of North America, his book may be relied upon as practically complete. We regret, however, that the omitted species should not have been included in an appendix, however brief—were it only a mere list of names.

The letterpress is divided into three sections. The Introduction contains four chapters on the Life-history and Anatomy of Butterflies; the Capture, Preparation, and Preservation of Specimens; the Classification of Butterflies; and Books about North-American Butterflies.

The bulk of the book consists of descriptions (necessarily, but not unduly, brief) of the Butterflies of North America north of Mexico, thus covering the whole ground up to the boundaries of Messrs. Godman and Salvin's 'Biologia Centrali-Americana.' The arrangement followed is *Nymphalidæ* (including *Libytheinæ*), *Lemoniidæ*, *Lycænidæ*, *Papilionidæ* (including *Pierinæ*), and *Hesperiidæ* (including *Megathyminæ*). Scattered through the book are various digressions and quotations, poetical and other.

We hope that the author will carry out his intention of continuing his work by a book on the Moths of North America likewise, for such a work would be of still greater scientific and general value than even that before us.

Dr. Holland appears to have done his work very well, and we hope that it will also be appreciated on this side of the Atlantic, for there are surely many British and European entomologists who will be glad of an opportunity of making themselves acquainted with a fauna which presents such a remarkable resemblance to our own; though, apart from the presence of some purely American or representative forms, the proportion which the number of species of the various groups bears to each other in Europe and North America is often strangely different; for example, the *Satyrinæ*, which form the bulk of the middle-sized butterflies in Europe, are very poorly represented in North America.

MISCELLANEOUS.

Note on Ceroplastes africanus (*Family* Coccidæ).

By E. E. Green, F.E.S.

The following is an extract from a letter I have received from Mr. E. E. Green. I think I shall best fulfil his wishes by publishing it as it is. Chas. O. Waterhouse.

"Prof. Cockerell has drawn my attention to the fact that he published a description of a *Ceroplastes egbarum* (from W. Africa) in the 'Entomologist' of May 1899. He has also sent me typical examples of the insect, which show me that it is identical with my *C. africanus* (var. *cristatus*) [Ann. & Mag. Nat. Hist. 1899, iv. p. 190]. Prof. Cockerell in his description gives the number of antennal joints as six only, but he particularly mentions that his specimens were not in very good preservation. . . . . I should be greatly obliged if you would send a short note to the 'Annals and Magazine' to correct the name." E. Ernest Green.

On the Lateral Cephalic Organs of Glomeris.

By N. de Zograf.

The celebrated German anatomist Francis Leydig has depicted, on one of the plates accompanying his unfinished work 'Ueber den Bau des thierischen Körpers,' published in 1864, a head of *Glomeris*, having on its lateral walls two horseshoe-shaped organs presenting in their interior a somewhat considerable cavity which communicates with the outside by means of a very narrow longitudinal slit. Leydig has shown that the internal wall of these organs is very thick, that it is innervated by a branch coming from the neck in the region of the optic trunk, and hence that these structures ought to be looked upon as organs of sense.

Following Leydig, the Hungarian zoologist Cömösvary described the same organs in several myriapods without giving a more detailed account of them; it is by the name of *Cömösvary* that they are to-day designated. The French zoologist Saint-Rémy and the German entomologist Curt Hennings so call them, the latter having given a description of their histology in the third number of the 'Sitzungsberichte der Gesellschaft naturforschenden Freunde zu Berlin' for the year 1899.

In my article on the relationships of the Arthropoda, published in 1892 in the 'Comptes Rendus du Congrès international de Zoologie,' I pointed out what great morphological interest these organs possess, especially if they are compared with the embryonic cephalic grooves of other myriapods, of some insects and crustaceans, and with the cephalic organs of some annelids, for example the Capitellidæ. Unfortunately *Glomeris* is very rare in Russia and only met with in the south-western portion of the empire; it was not therefore until the summer of 1898 that, through the kindness of M. E. Bouvier, Professor at the Jardin des Plantes, I was able to obtain enough material for my researches. I then received specimens of *Glomeris marginata* which M. Bouvier had collected in the forests in the neighbourhood of Dieppe. Every animal composing two successive consignments had perished during the long journey from Dieppe to Moscow; but a third batch sent after the great heat of the summer arrived safe and sound at Moscow, and provided me with material for my researches.

The lateral cephalic organs of *Glomeris* have a very curious and

original structure. Herr Hennings has shown that the thickness of the inside wall of these structures consists of sensitive epithelial cells, the nuclei of which are found in the proximal parts, while the more superficial layers contain some small granules in the protoplasm of the cells. Herr Hennings rightly considers the cells of this wall of the organs to have a nervous function ; those which he represents in his figure 2, and which he calls cells of the sensitive epithelium, are glandular cells. The structure of the internal wall in question of the lateral organ is considerably complicated.

The wall consists of very abundant glandular cells, which communicate by means of very narrow canals with the bottom of the cavity of the organ ; on the chitinous surface of the bottom minute pores even may be made out through which the secretion of the cells enters the cavity of the organ.

Besides the glandular cells there are to be seen in the still more proximal layers not far from the cells of the adipose tissue large ganglionic cells, which are prolonged at their proximal ends into the nerves which spring from the main nerve of the organ, while at their distal extremities they are drawn out into long terminal nervous filaments ; these filaments, which can be well seen when examined by Ramon y Cajal's method, reach the chitinous layer and sometimes raise it, forming little cushions. If a section is made parallel to the surface of the cavity, it can be distinctly seen that each terminal filament, which has here a structure recalling the rhabdomeres in the sense-organs of Arthropoda, is surrounded by the canals of glandular cells. The latter form polygonal figures recalling the meshes in tulle net, and in the centre of the meshes a nervous filament ends.

Between the canals of glandular cells very abundant concretions are found ; these stain with all the colouring reagents and remain after boiling in caustic potash.

The combination of glandular and sense-cells and their structure strongly recall olfactory organs, and I think that one ought to attribute such a function to the organs in question.

The structure as well as the evident function of the lateral cephalic organs of *Glomeris* approach those of the cephalic organs of segmented worms. If we remember that *Peripatus* retains traces in its adult stage of the cephalic organs well developed in the embryos and young examples, and that several other arthropods present in their development traces of remarkable cephalic organs, if we recollect, again, that the relationship between the segmented worms and the arthropods through the link furnished by *Peripatus* becomes more and more evident, we can evolve the hypothesis that the lateral cephalic organs of *Glomeris* are homologous with, and even perhaps analogous to, the cephalic organs of annelids.—*Comptes Rendus*, t. cxxix. (1899) pp. 504–506.

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XVIII.—*On the Nephridium of* Nephthys cæca, *Fabr.* By Francis Hugh Stewart, M.A., Gatty Marine Laboratory, St. Andrews.

[Plates II. & III.]

During the summer of 1899, while working at the Gatty Marine Laboratory, St. Andrews, it was suggested to me by Professor M'Intosh that, in view of the wonderful supply of living material obtainable in St. Andrews Bay, it might be profitable to continue the work of Mr. Edwin Goodrich on the nephridium of *Nephthys* (Q. J. M. S. no. 157). In so doing I have been able to confirm Mr. Goodrich's results in all points except one—the position of the organ relative to the blood-vessels. This, as described and figured by him, is briefly as follows:—The ciliated organ lies in the angle between the dorso-ventral vessel and the branch *x* (Pl. II. fig. 1); the nephridial tube passes down the dorso-ventral and along the branch *y*, the solenocyte-bearing tuft resting in the angle between the dorso-lateral and the branch *x*.

After a most careful examination of the subject, I have come to a different conclusion. The ciliated organ rests, not between the dorso-ventral and *x* (Pl. II. fig. 1), but at the junction of the ventro-lateral, the dorso-ventral, and *y*; the solenocyte-bearing tuft lies in the angle between the ventro-lateral and the dorso-ventral, not between the dorso-lateral

and x; while the nephridial tube runs along the branch (y) which passes to the vascular tuft (*c.p*) (not figured by Goodrich), and does not in any part of its course touch the dorso-ventral.

The Excretion of Solid Matter and the Function of the Ciliated Organ.

In examining under the microscope a nephridium which has been carefully dissected out from a hardened specimen, the nephridial canal will be seen as a conspicuous green tube lying along the blood-vessel y (Pl. II. fig. 2) on its outer and posterior side. Up this blood-vessel it runs until it reaches a point opposite the base of the ciliated organ; here it bends sharply round in front of y, passes across to the ventro-lateral branch, and forming a semicircle round this, it appears on the posterior and inner side of the ciliated organ, where it terminates in the solenocyte-bearing tuft (Pl. II. fig. 2, *s.t.*).

It is the portion of the tube between the ventro-lateral and y that demands special attention, for here alone is it in close contact with the ciliated and grooved side of the ciliated organ. Indeed it here forms a miniature barrier at the exact point where the grooves and the streams induced by the ciliary action converge (figs. 3 & 4).

The importance of this disposition is extremely well illustrated by placing a living nephridium in a drop of sea-water laden with carmine particles. The red grains may be seen carried by the currents down the grooves of the ciliated organ, and deposited against the barrier of the nephridial tube until a solid mass is formed.

Again, I observed that the yellow-green coloration caused by the presence of excretory matter in the walls of the tube extends only as far as the ventro-lateral vessel (*b*, Pl. II. fig. 3), and is not continued up to the solenocyte-bearing tuft.

These considerations suggested that it would be in the short stretch of the tube between the ventro-lateral vessel and y that solid excretory matter would be taken up.

The following facts appear to confirm this view :—

(1) When a nephridium is extracted it may be noticed that there is always present against this barrier a mass of phagocytes from the cœlomic fluid filled with yellow-green excretory matter (figs. 3 & 5). These are evidently carrying waste products to this part of the tube, and I have actually observed one of these cells entering the wall at this point (Pl. III. fig. 4, *p*).

(2) In specimens injected with powdered carmine (in sea-water) the phagocytes laden with the grains collect here, forming a prominent scarlet mass; but only in one case have I found a carmine granule in the wall of the tube.

Before describing the process of excretion some notice of the cœlomic fluid is necessary.

Floating free in the fluid are found two varieties of cells:—

(1) Cells of highly granular appearance (Pl. III. fig. 6), which usually present a rounded form, but on careful inspection prove to be amœboid. In some there is the appearance of a firm ectosarc or cuticle, in others small bud-like outgrowths occur, and in several cases I have found them in a state of degeneration when loaded with excretory matter (Pl. III. fig. 8). These cells are the phagocytes already referred to. In almost every case they contain the characteristic yellow-green matter, and in injected specimens are filled with carmine grains.

(2) Oval cells of clear protoplasm (Pl. III. fig. 7). At the narrower end occurs a clear highly refractive nucleus. These cells do not appear to be concerned in excretion, and I have never observed any foreign bodies in them. They are identical in appearance with the corpuscles of the blood.

To sum up, the process of excretion appears to be as follows:—

Whenever a particle of solid excretory matter appears in the cœlom it is immediately engulfed by one of the phagocytes. This, when it has become sufficiently loaded, passes into the neighbourhood of the ciliated organs, either by its own amœboid motion or by the agency of the currents raised by the cilia. Here it is swept down one of the grooves, and joins the little mass of its fellows raised against the barrier of the nephridial tube. Partial degeneration now sets in, and the phagocyte appears to bodily enter the protoplasmic wall of the canal (Pl. III. fig. 4, *p*), carrying the foreign matter with it. The latter then passes out either by the lumen of the canal, assisted by the cilia, or by passing along through the wall itself.

The whole nephridium is in a state of constant motion, the ciliated organ swaying up and down, the tube also moving upward and downward on the blood-vessels to a limited extent. These movements no doubt facilitate the ingestion of refuse into the tube, bringing different parts of it into action consecutively.

I have not been able definitely to determine whether the solid excretory matter before being transferred to the nephridial tube is dissolved by the phagocyte or not; but most of the evidence suggests that it is. The green matter in the walls of the canal has the appearance of minute droplets rather than of solid granules, while only in one case have I been able to detect a solid carmine particle in the wall, notwithstanding the fact that great masses of carmine were raised against it by the action of the ciliated organ. In addition, the process at this point is extremely slow—specimens which I have allowed to live for several days after injection still showed great masses of carmine-laden phagocytes at the barrier, although there were none free in the cœlom. This delay seems to point to something more complicated than simple transference of solid particles.

The importance of the above process can only be fully appreciated by noting the resemblance to that in the Glyceridæ, as described by Mr. Goodrich (Q. J. M. S. no. 163). Indeed, if we substitute for the nephridial sac of *Glycera* the short stretch of the nephridial tube between the ventro-lateral vessel and *y*, the processes are largely identical. This portion of the tube is evidently the physiological equivalent of the sac. Morphologically it is also easy to connect the two organs, the tube-barrier of *Nephthys* having broadened and become cup-shaped, while the ciliated organ has grown in as a lining, forming a much more efficient lodgment for the laden phagocytes while discharging their burdens than the more primitive apparatus in *Nephthys* (Q. J. M. S. no. 163, p. 446).

EXPLANATION OF PLATES II. & III.

Reference letters.

d. Dorsal blood-vessel.	*c.p.* Vascular tuft.
v. Ventral blood-vessel.	*neph.tube.* Nephridial tube.
dl. Dorso-lateral.	*c.o.* Ciliated organ.
vl. Ventro-lateral.	*s.t.* Solenocyte-bearing tuft.
dv. Dorso-ventral.	*p.* Laden phagocyte.

Fig. 1. Diagrammatic transverse section of *Nephthys cæca*, showing position of nephridium relative to the blood-vessels. To the right, as given by Goodrich.

Fig. 2. Diagrammatic reconstruction of the nephridium.

Fig. 3. Ciliated organ and terminal portion of the nephridium. Corrosive sublimate, sat. sol. Zeiss D.

Fig. 4. Nephridial barrier from same. Zeiss F.

Fig. 5. Ciliated organ and terminal portion of nephridium. From specimen injected with carmine.

Fig. 6. Phagocytes from cœlomic fluid. Zeiss F.

Fig. 7. Hyaline corpuscles from cœlomic fluid. Zeiss F.

Fig. 8. Laden phagocytes. Zeiss F.

XIX.—*Descriptions of Three new Species of Siluroid Fishes from Southern Brazil.* By G. A. Boulenger, F.R.S.

The fishes here described were collected in the Province São Paulo by Mr. H. K. Heyland, and presented by him to the British Museum.

Plecostomus Heylandi.

Head longer than broad, $3\frac{2}{3}$ times in total length, simply convex, without keels; snout rounded, naked at the end; diameter of eye 9 times in length of head, $3\frac{1}{2}$ times in interorbital width; barbel extremely short, about $\frac{1}{2}$ diameter of eye; series of teeth in both jaws forming a doubly curved series interrupted in the middle, about 70 teeth in each series; lower lip much developed, covered with strong flat papillæ, with slightly fringed border; interopercular spines none. Lower surfaces, from the mouth to the anal fin, perfectly naked. Dorsal I 7; first ray scarcely longer than snout, or than the distance from its extremity to the adipose fin. Pectoral spine half length of head, merely rugose. Ventrals I 5, the first ray much thickened. Anal I 4. Caudal squarely truncate. Depth of caudal peduncle 3 times in distance between anal and caudal fins. No posthumeral keel. Scutes on body rough and spinulose, but not keeled; lat. l. 28; 13 scutes between anal and caudal fins. Olive-brown above, without spots; dorsal, pectoral, ventral, and anal fins spotted with black.

Total length 150 millim.

A single specimen from a mountain stream 400 feet above sea-level near Santos.

Loricaria latirostris.

Teeth small, well developed, 14 or 16 in each jaw. Head much depressed, $1\frac{1}{3}$ as long as broad, nearly 4 times in total length; snout rounded, feebly projecting beyond the lip, measuring half the length of the head; head-shields very rough with spinose tubercles; three very obtuse ridges on the snout; long, close-set, hair-like bristles on the sides of the head, from the end of the snout to the gill-cleft; diameter of eye 10 times in length of head, $2\frac{1}{3}$ in interorbital width; a strong postorbital notch; lower labial lobe large, strongly papillose, strongly fringed. Dorsal I 7; first ray $\frac{3}{4}$ length of head, just above middle ventral rays. Pectoral I 6, $\frac{2}{3}$ length of head, rough with small spines. Ventral I 5, as long as

pectoral, reaching origin of anal. Anal I 5. Upper caudal ray but little produced. Lateral scutes 27 or 28, with two obtuse ridges, united on the seventeenth or eighteenth; nuchal shields without keels; 17 scutes between dorsal and caudal, 15 between anal and caudal. Breast naked; ventral shields 4 or 6 transversely enlarged ones on each side and 3 series of small irregular ones in the middle. All the shields spinulose, the spinules larger on the sides. Olive above, with 4 darker transverse bands; the bristles on the side of the head reddish brown.

Total length 360 millim.

Two specimens from the Mogy-guassu River, about 250 miles inland of Santos.

Loricaria paulina.

Teeth small, well developed, 12 or 14 in each jaw. Head much depressed, $1\frac{1}{3}$ or $1\frac{1}{4}$ as long as broad, 4 or $4\frac{1}{4}$ times in total length; snout pointed, projecting beyond the lip, measuring half the length of the head; head-shields rough with small spines; three very obtuse ridges on the snout; two feeble ridges on the occipital shield, diverging behind; diameter of eye 8 times in length of head, nearly twice in interorbital width; a strong postorbital notch; lower labial lobe large, strongly papillose, strongly fringed. Dorsal I 7; first ray nearly $\frac{3}{4}$ length of head, just above middle ventral rays. Pectoral I 6, not quite $\frac{2}{3}$ length of head. Ventral I 5, as long as pectoral, reaching origin of anal. Anal I 5. Caudal truncate, upper ray not produced. Lateral scutes 28, with two obtuse ridges, united on the eighteenth or nineteenth; nuchal shields with two very feeble keels; 17 scutes between dorsal and caudal, 15 between anal and caudal. Breast naked; ventral shields, 5 to 8 transversely enlarged ones on each side and 3 series of small irregular ones in the middle. All the shields spinulose. Olive above, with 5 darker transverse bands; fins white, spotted with black, the spots having a more or less marked tendency to form transverse bands; the edge of the dorsal and caudal white.

Total length 210 millim.

Two specimens from the Mogy-guassu River.

I have hesitated before describing this fish as a new species, as it might prove to be the female of the preceding. Since, however, the differences are greater than such as are known to be merely secondary sexual in other members of the genus, the course I have provisionally followed appears to me the safest from the point of view of scientific accuracy.

XX.—*Notes on the* Pangoninæ *of the Family* Tabanidæ *in the British Museum Collection.* By Miss Gertrude Ricardo.

[Concluded from p. 121.]

Asia.

Pangonia, Latr.

Pangonia, Rond.

P. rufa, ♀, Macq., Dipt. Exot. Suppl. 4, p. 18 (1850); Wulp, List Diptera S. Asia, p. 64 (1896).—*Hab.* Bombay, India.

P. obscurata, Loew, Neue Dipt. Beiträge, vi. p. 27 (1853).—*Hab.* Island Rhodes and Asia Minor.

P. fulvipes, Loew, *l. c.*; Loew, Berlin ent. Zeitschr. xii. p. 369 (1868).—*Hab.* Cilicia, Turkey in Asia.

**P. zonata*, ♀, Walker, Ent. v. p. 256 (1870).—*Hab.* Tajura Straits, Bab-el-Mandeb.

Subgenus Corizoneura, Rond.

**C. longirostris*, Hardw., Trans. Linn. Soc. xiv.; Wiedem., Auss. zweifl. Ins. ii. p. 621 (1830); Walker, List Dipt. pt. i. p. 131 (1848); Rondani, Canestr. Archiv. per Zool., Anat. e Fis. iii. (1863); Röder, Stett. ent. Zeitschr. xliii. p. 384 (1881).—*Hab.* Nepaul, Thibet.

**C. taprobanes*, ♀, Walker, List Dipt. pt. v. Suppl. 1, p. 324 (1854).—*Hab.* Ceylon.

C. tigris, Bigot, Ann. Soc. Ent. Fr. (5) x. p. 143 (1880).—*Hab.* North Persia or Caucasus.

Pangonia, Latr.

P. amboinensis, Fabr., Syst. Antl. p. 91. 7 (1805); Wiedem., Auss. zweifl. Ins. i. p. 92 (1828); Walker, List Dipt. pt. i. p. 131 (1848); id. *l. c.* pt. v. Suppl. 1, pp. 139, 324 (1854).—*Hab.* Amboina.

P. subfasciata, Walker, Ent. v. p. 257 (1870). This type is not to be identified in the Museum coll.—*Hab.* Tajura.

Pangonia, Latr.

Pangonia, Rond.

Wings with first posterior cell closed. *Eyes* bare.

Pangonia zonata, ♀, Walker, Ent. v. p. 256 (1870).

This is a female, not a male as Walker states.

The palpi have the first joint twice as long as the second, which is club-shaped and grooved. Wings have a short appendix on fork of third longitudinal vein.

Hab. Tajura Straits, Bab-el-Mandeb (*Lord*).

Diatomineura, Rond.

Subgenus Corizoneura, Rond.

Wings with first posterior cell open. *Eyes* bare.

Corizoneura taprobanes, ♀, Walker, List Dipt. pt. v. Suppl. 1, p. 324 (1854).

The type in the Museum is var. *b*; the other is not to be identified.

The palpi are small; the second joint thick at base, tapering to a point, shorter than the first joint. Wings have an appendix on fork of third longitudinal vein.

Hab. Ceylon, Nilghiri Hills (*Hampden*).

Corizoneura longirostris, ♂ ♀, Hardw. Trans. Linn. Soc. xiv.; Wiedem., Auss. zweifl. Ins. ii. p. 621 (1830); Walker, List Dipt. pt. i. p. 131 (1848); Rondani, Canestr. Archiv. per Zool., Anat. e Fis. iii. (1863); Röder, Stett. ent. Zeitschr. xliii. p. 384 (1881).

The males have the prolongation on fore tarsi as in some African species. Röder mentions it. One or two of the females have long bristles on these joints. The first posterior cell is closed in some of the females with a short petiole. Two males, one of which was wrongly labelled "*amboinensis*, Fabr.," seem a variety of this species, having no prolongation on the fore tarsi; the third joint of antennæ is bright red, not black. The yellow colour on the abdomen is more prominent; the face is shining and dark, with hardly any greyish pubescence.

Hab. North-west India; Muktesar, North-west Provinces (*Lingard*); Thibet (*Landor*).

America.

Pangonia, Latr.

North America.

The species north of Mexico are placed first, and lastly those south of the North Mexican boundary, following Osten Sacken's arrangement in his Cat. of North-American Diptera, 1878; but the species from the West Indies are placed under South America.

PANGONIA, Rond.

**P. fusiformis*, ♀, Walker, Dipt. Saund. pt. i. p. 19 (1854). [? *translucens*, Macq., Dipt. Exot. Suppl. 1, p. 27; var., Walker, *l. c.*; Osten Sacken, Cat. Dipt. N. Amer. (1878).]—*Hab.* N. America.

P. semiflava, Wiedem., Auss. zweifl. Ins. ii. p. 622 (1830); Walker, List Dipt. pt. v. Suppl. 1, p. 121 (1854); Bellardi, Saggio, i. p. 51 (1859). [*P. bicolor*, Macq., Dipt. Exot. Suppl. 4, p. 27 (Bellardi) (1849); Osten Sacken, *l. c.*]—*Hab.* Mexico.

P. planiventris, Macq., *l. c.* p. 26; Osten Sacken, *l. c.*—*Hab.* Mexico.

P. nigronotata, Macq., *l. c.* p. 27; Bellardi, *l. c.*; Osten Sacken, *l. c.*—*Hab.* Mexico.

**P. atrifera*, ♂, Walker, Trans. Ent. Soc. v. p. 272 (1860); Osten Sacken, *l. c.*—*Hab.* Mexico.

P. Saussurei, Bellardi, *l. c.* p. 47; Osten Sacken, *l. c.*—*Hab.* Mexico.

P. Wiedemanni, Bellardi, *l. c.* p. 48. [*P. basilaris*, Wiedem., Auss. zweifl. Ins. ii. p. 621 (1830) (name was changed by Bellardi); Osten Sacken, Mem. Boston Soc. Nat. Hist. p. 475 (1876); Osten Sacken, Cat. (1878); see Stett. ent. Zeit. xlvii. p. 261 (1886).]—*Hab.* Mexico.

P. flavohirta, Bellardi, *l. c.* p. 49; Osten Sacken, Cat. (1878).—*Hab.* Mexico.

P. Sallei, Bellardi, *l. c.* p. 50; Osten Sacken, *l. c.*—*Hab.* Mexico.

P. incerta, Bellardi, *l. c.*; Osten Sacken, *l. c.*—*Hab.* Mexico.

**P. tenuirostris*, ♂, Walker, *l. c.*; Osten Sacken, *l. c.*—*Hab.* Mexico.

P. caustica, Osten Sacken, Biol. Centr.-Amer., Dipt. i. (1886).—*Hab.* Mexico.

Subgenus EREPHROSIS, Rond.

E. rostrifera, Bellardi, *l. c.* p. 47; Osten Sacken, *l. c.*—*Hab.* Mexico.

DIATOMINEURA, Rond.

D. dives, Williston, Trans. Kans. Ac. x. p. 130 (1886).—*Hab.* N. America.

D. californica, Bigot, Mém. Soc. Zool. Fr. v. p. 618 (1892).—*Hab.* California.

D. rhinophora, Bellardi, *l. c.* p. 46; Osten Sacken, *l. c.*—*Hab.* Mexico.

Subgenus CORIZONEURA, Rond.

C. fera, Williston, *l. c.*—*Hab.* N. America.

C. velutina, Bigot, *l. c.* p. 615.—*Hab.* California.

C. ruficornis, Bigot, *l. c.*—*Hab.* California.

PANGONIA, Latr.

P. isabellinus, Wiedem., Auss. zweifl. Ins. i. p. 112 (1830); Walker, Cat. Dipt. pt. v. Suppl. 1, p. 274 (1854); Osten Sacken, *l. c.* (note). [*Silvius isabellinus*, Wiedem., *l. c.*]—*Hab.* N. America.

P. incisa, Wiedem., *l. c.* p. 90; Walker, *l. c.* p. 120; Osten Sacken, Western Diptera, p. 214 (1877). [*P. incisuralis*, Say, see Osten Sacken, Cat. (1878).]—*Hab.* Arkansas.

P. macroglossa, Westwood, Lond. Edin. Phil. Mag. (1835); see Osten Sacken, Mem. Boston Soc. Nat. Hist. p. 368 (1876); id. Cat. (1878). —*Hab.* Georgia.

P. tranquilla, Osten Sacken, *l. c.* p. 367; id. Cat.—*Hab.* Pennsylvania.
P. pigra, Osten Sacken, *l. c.*; id. Cat.—*Hab.* New York.
P. chrysocoma, Osten Sacken, *l. c.* p. 368; id. Cat.—*Hab.* New York.
P. hera, Osten Sacken, Western Diptera, p. 214 (1877).—*Hab.* San Francisco.
P. rasa, Loew, Dipt. Am. Sept. viii. p. 7; Loew, Berlin. ent. Zeitschr. xiii. (1869); Osten Sacken, Mem. Boston Soc. Nat. Hist. p. 366 (1876); id. Cat. (1878).—*Hab.* Illinois.
P. aurulans, Wiedem., *l. c.* ii. p. 620; Walker, *l. c.* pt. v. Suppl. 1, p. 120 (1854); Osten Sacken, Cat.—*Hab.* Mexico.

Pangonia, Rond.

Wings with first posterior cell closed. *Eyes* bare.

Pangonia fusiformis, ♀, Walker, Dipt. Saund. pt. i. p. 19 (1850); O. S. Cat. Dipt. N. Amer. (1878).

Walker's description should be amended thus :—Abdomen with first and second segments transparent yellow, in middle of second segment a long brown spot; third segment brown, its extreme anterior and posterior margins yellow; the remaining segments brown, darker in colour on the posterior margins; on the underside there is no brown spot on the second segment, and only the anterior margin of third segment is yellow. Palpi curved, the same width throughout.

This species belongs to the same group as the South-American species *arcuata*, *filipalpis*, Will., &c.

Hab. Mexico.

Pangonia tenuirostris, ♂, Walker, Trans. Ent. Soc. v. p. 272 (1860); O. S. Cat. Dipt. N. Amer. (1878).

The wings have a long appendix on fork of the third longitudinal vein.

Hab. Mexico.

Pangonia atrifera, ♂, Walker, *l. c.*; O. S. Cat. Dipt. N. Amer. (1878).

The last joint of the palpi is red. There are a few orange hairs on the lateral margins of the last segments. Wings have an appendix.

Hab. Mexico.

South America (including Central America and the West Indies).

Pangonia, Rond.

**P. fuscipennis*, Wiedem., Auss. zweifl. Ins. i. p. 95 (1830); Macq., Dipt. Exot. i. p. 103 (1838).—*Hab.* Brazil.

P. ferruginea, Macq., *l. c.* vol. i. pt. ii p. 179; Walker, Cat. Dipt. pt. v. Suppl. 1, p. 129 (1854).—*Hab.* Brazil.

P. translucens, Macq., *l. c.* Suppl. 1, p. 27 (1846); Walker, *l. c.* p. 131. —*Hab.* Brazil.

**P. prasiniventris*, Macq., *l. c.* p. 29; Walker, *l. c.* p. 130; Schiner, Reise der Novara, p. 99 (1866); Osten Sacken, Biol. Centr.-Am., Dipt. i. p. 45 (1886).—*Hab.* Colombia.

P. incisuralis, Macq., *l. c.* Suppl. 2, p. 12; Walker, *l. c.* p. 127.—*Hab.* ? Brazil.

P. testaceiventris, Macq., *l. c.* Suppl. 3, p. 9; Walker, *l. c.* p. 125; Schiner, *l. c.* p. 99.—*Hab.* Quito, Peru.

**P. subvaria*, ♀, Walker, *l. c.* pt. i. p. 150, pt. v. Suppl. 1, p. 128. [*Tabanus subvarius*, Walker, *l. c.* pt. i. p. 150.]—*Hab.* Venezuela.

**P. notabilis*, ♀, Walker, Dipt. Saund. pt. i. p. 18 (1850).—*Hab.* S. America.

**P. umbra*, ♀, Walker, *l. c.* p. 19.—*Hab.* Chili.

**P. arcuata*, Williston, Kans. Univ. Quart. iii. p. 190 (1895).—*Hab.* Brazil.

**P. filipalpis*, Williston, *l. c.*—*Hab.* Paraguay.

**P. flavescens*, ♀, sp. n.—*Hab.* Brazil.

Subgenus Erephrosis, Rond.

**E. fulvithorax*, Wiedem., *l. c.* p. 89; Osten Sacken, Cat. N. Amer. Dipt. (1878); Williston, Kansas Univ. Quart. iii. p. 189 (1895). [*Sackenymia fulvithorax*, Wiedem., Bigot, Ann. Soc. Ent. Fr. (5) ix. (1879).]—*Hab.* Cuba and Brazil.

**E. Winthemi*, Wiedem., *l. c.* p. 91; Walker, *l. c.* pt. v. Suppl. 1, p. 127. —*Hab.* Brazil.

**E. sorbens*, Wiedem., *l. c.* p. 92. [♀ var., Walker, Cat. Dipt. pt. v. Suppl. 1, p. 323 (type not to be identified).]—*Hab.* Monte Video, Santarem.

**E. leucopogon*, Wiedem., *l. c.*; Macq., Ann. Soc. Ent. Fr. vi. p. 429 pl. xv. (1837); Walker, *l. c.* p 128.—*Hab.* Brazil.

**E. Beseckii*, Wiedem., *l. c.* p. 97; Walker, *l. c.* pt. v. Suppl. 1, p. 125.—*Hab.* Brazil.

E. ardens, Macq., *l. c.* i. p. 103; Walker, *l. c.* p. 130.—*Hab.* St. Leopold, Brazil.

E. aurimaculata, Macq., *l. c.* p. 105; Walker, *l. c.* p. 125.—*Hab.* Brazil.

E. eriomera, Macq., *l. c.* p. 106; Walker, *l. c.*; Blanchard, Hist. fis. y polit. Chili, vii. p. 389 (1854).—*Hab.* Brazil.

**E. depressa*, Macq., *l. c.* p. 107; Macq., *l. c.* Suppl. 4, p. 25 (1850); Walker, *l. c.* p. 126; Blanchard, *l. c.* p. 388; Schiner, Verh. z.-b. Gesell. Wien, xv. p. 712 (1865); Schiner, Reise der Novara, p. 120 (1866). [*Pangoma crocata*, Jænnicke, Abh. Senck. Gesell. vi. p. 330 (1868); v. der Wulp, Tijd. Ent. xxiv. (2) p. 156 (1881).]—*Hab.* Chili.

E. albifrons, Macq., *l. c.* p. 108; Walker, *l. c.* p. 125; Blanchard, *l. c.* p. 389.—*Hab.* Chili.

E. xanthopogon, Macq., *l. c.* vol. i. pt. ii. p. 179; Walker, *l. c.* p. 129. —*Hab.* Brazil.
E. fenestrata, Macq., *l. c.* Suppl. 1, p. 26; Walker, *l. c.* p. 125.—*Hab.* Brazil.
E. longirostris, Macq., *l. c.* Suppl. 2, p. 12.—*Hab.* ? Brazil.
E. minor, Macq., *l. c.* p. 29; Walker, *l. c.*—*Hab.* ? America.
E. nigrivittata, Macq., *l. c.* Suppl. 4, p. 23.—*Hab.* Brazil.
**E. nigro-hirta*, ♀, Walker, *l. c.* pt. i. p. 131 (1848).—*Hab.* Brazil.
**E. rufo-hirta*, ♀, Walker, *l. c.*—*Hab.* Brazil.
**E. badia*, ♂, Walker, *l. c.* p. 132.—*Hab.* Brazil.
**E. piceo-hirta*, ♀, Walker, *l. c.*—*Hab.* Brazil.
**E. basalis*, ♀, Walker, *l. c.* p. 133. [var. ♀, Walker, pt. v. Suppl. 1, p. 322.]—*Hab.* R. Tapajos, Brazil.
**E. tenuistria*, ♀, Walker, *l. c.* p. 143.—*Hab.* Brazil.
**E. fumifera*, ♀, Walker, *l. c.* pt. v. Suppl. 1, p. 324.—*Hab.* Santarem, Brazil.
**E. nana*, ♂, Walker, Dipt. Saund. pt. i. p. 11 (1850).—*Hab.* Brazil.
E. laterina, Rond., Nuovi Ann. Sci. Nat. (3) ii. p. 370 (1850).—*Hab.* Equatorial America.
**E. rufo-aurea*, Philippi, Verh. z.-b. Gesell. Wien, xv. p. 708 (1865).—*Hab.* Chili.
E. atripes, Röder, Stett. ent. Zeit. xlvii. p. 261 (1886).—*Hab.* Bolivia.
E. bahiana, Bigot, Mém. Soc. Zool. Fr. v. p. 612 (1892).—*Hab.* Brazil.
**E. auripes*, ♀, sp. n.—*Hab.* Pará, Amazons.
**E. fulvitibialis*, ♀, sp. n.—*Hab.* Brazil.

Diatomineura, Rond.

D. tabanipennis, Macq., *l. c.* i. p. 105; Walker, *l. c.* pt. v. Suppl. 1, p. 131 (1854).—*Hab.* Brazil.
D. rufa, ♀, Macq., *l. c.* p. 106; Walker, *l. c.* p. 130.—*Hab.* Lima.
D. albithorax, Macq., *l. c.* p. 107; Walker, *l. c.* p. 125; Blanchard, *l. c.* p. 388; Schiner, Reise der Novara, p. 99.—*Hab.* Chili.
**D. viridiventris*, Macq., *l. c.* p. 108; Blanchard, *l. c.* p. 389; Schiner, *l. c.* —*Hab.* Chili.
D. unicolor, Macq., *l. c.* Suppl. 1, p. 27; Walker, *l. c.* p. 129; Williston, Kans. Univ. Quart. iii. (1895). This would belong to *Erephrosis*, Rond., according to Macq., but Williston gives the first posterior cell open.—*Hab.* Brazil.
D. dorsoguttata, Macq., *l. c.* Suppl. 4, p. 25; Blanchard, *l. c.* p. 390.—*Hab.* Chili.
D. latipalpis, Macq., *l. c.*; Blanchard, *l c.*—*Hab.* Chili.
**D. exeuns*, ♀, Walker, Dipt. Saund. pt. i. p. 12 (1850).—*Hab.* Brazil.
D. jucunda, Jænnicke, Abh. Senck. Gesell. vi. p. 327 (1866).—*Hab.* Chili.
D. grisea, Jænnicke, *l. c.* p. 331.—*Hab.* Chili.
D. morio, Wulp, Tijd. Ent. xxiv. (2) p. 156 (1881).—*Hab.* Argentine Republic.
D. pyrausta, O. Sacken, Biol. Centr.-Am., Dipt. i. (1887); Williston, *l. c.* (1895).—*Hab.* Panama.
D. lasiophthalma, Wulp, *l. c.* xxxi. p. 365 (1887).—*Hab.* Argentina.
D. hirtipalpis, Bigot, Mém. Soc. Zool. Fr. v. p. 618 (1892).—*Hab.* Chili.
**D. leucothorax*, ♀, sp. n.—*Hab.* Chili.

Subgenus Corizoneura, Rond.

C. longipalpis, Macq., *l. c.* Suppl. 3, p. 9; Walker, *l. c.* pt. v. Suppl. 1, p. 123.—*Hab.* Brazil.

C. vulpes, Macq., *l. c.* Suppl. 4, p. 24; Blanchard, *l. c.* p. 391.—*Hab.* Chili.

Pangonia, Latr.

P. analis, Fabr., Syst. Antl. p. 91. 6 (1805); Wiedem., *l. c.* i. p. 93; Walker, *l. c.* p. 123. [*Sackenymia analis*, Fabr., Bigot, Bull. Soc. Ent. Fr. (5) ix. (1879).]—*Hab.* S. America.

P. Macquartii, Guérin, Voyage 'Coquille,' ii. pt. ii. p. 289 (1830).—*Hab.* Chili.

P. nigripennis, ♀, Guérin, *l. c.* [? *P. nigro-hirta*, Walker, *l. c.* pt. i. p. 131.]—*Hab.* Brazil.

P. thoracica, Guérin, *l. c.* [? *P. fulvithorax*, Wiedem., *l. c.* p. 89.]—*Hab.* Brazil.

P. venosa, Wiedem., *l. c.* p. 87; Walker, *l. c.* pt. v. Suppl. 1, p. 126 (1854); Williston, Kans. Univ. Quart. iii. (1895).—*Hab.* Brazil.

P. lingens, ♀, Wiedem., *l. c.*; ♂, Macq. *l. c.* i. p. 102; Walker, *l. c.* p. 129; Blanchard, *l. c.* p. 387.—*Hab.* Brazil.

P. molesta, Wiedem., *l. c.* p. 91; Walker, *l. c.* p. 127.—*Hab.* Brazil.

P. marginalis, Wiedem., *l. c.* ii. p. 620; Walker, *l. c.* p. 128.—*Hab.* Cassapawa, Brazil.

P. basilaris, Wiedem., *l. c.* p. 621.—*Hab.* S. America.

P. fasciata, Macq., *l. c.* p. 103; Macq., Hist. Nat. Dipt. i. p. 194; Walker, *l. c.* p. 127.—*Hab.* Brazil.

P. lugubris, Macq., *l. c.* p. 104; Walker, *l. c.* p. 123.—*Hab.* Brazil.

P. fascipennis, Macq., *l. c.* p. 107; Walker, *l. c.* p. 131; Blanchard, *l. c.* p. 387; Schiner, Reise der Novara, p. 98 (1866).—*Hab.* Chili.

P. suturalis, Rond., Studi Ent. Baudi e Turqui, i. p. 107 (1848); Walker, *l. c.* p. 323.—*Hab.* Brazil.

P. chlorogaster, Philippi, Verh. z.-b. Gesell. Wien, xv. p. 708 (1865).—*Hab.* Chili.

P. collaris, Philippi, *l. c.* p. 709.—*Hab.* Chili.

P. atra, Philippi, *l. c.*—*Hab.* Chili.

P. subandina, Philippi, *l. c.*—*Hab.* Chili.

P. australis, Philippi, *l. c.* p. 710.—*Hab.* Chili.

P. obscuripennis, Philippi, *l. c.*—*Hab.* Chili.

P. vittata, Philippi, *l. c.* p. 711.—*Hab.* Chili.

P. diaphana, Schiner, Reise der Novara, p. 99 (1866); Williston, Kans. Univ. Quart. iii. (1895).—*Hab.* Colombia.

Pangonia, Rond.

Wings with first posterior cell closed. *Eyes* bare.

Pangonia prasiniventris, Macq., Dipt. Exot. Suppl. 1, p. 29 (1846); Walker, List Dipt. pt. v. Suppl. 1, p. 130 (1854); Schiner, Reise der Novara, p. 99 (1866); Osten Sacken, Biol. Centr.-Amer., Dipt. i. p. 45 (1886).

Two females belong here which were incorrectly labelled *viridiventris*, Macq.

Hab. Colombia, Venezuela, Trinidad.

Pangonia notabilis, ♀, Walker, Dipt. Saund. pt. i. p. 18 (1850).

The type is a female, not a male as Walker says. The palpi have the second joint long, curved, one width throughout. The underside of the abdomen has three rows of black spots. The wings have an appendix. This and *subvaria*, *umbra*, Walker, *filipalpis*, *arcuata*, Will., *fuscipennis*, Wiedem., and *flavescens*, sp. n., from South America, and *fusiformis*, Wlk., from North America, form a well-marked group, distinguished by the shape of the palpi and antennæ, the latter with the first annulation of the third joint wide, and the last one nearly as long as the four preceding together. They are large flies, with long-shaped abdomen.

Hab. South America (*Saunders*).

Pangonia arcuata, Will., Kansas Univ. Quart. iii. p. 190 (1895).

Two females.

Hab. ? Amazons (*Bates*).

Pangonia filipalpis, Will., Kansas Univ. Quart. *l. c.*

One female.

Hab. ? Amazons (*Bates*).

Pangonia flavescens, ♀, sp. n. (Pl. I. figs. 6, 6 *a*.)

This was incorrectly placed by Walker under *Tabanus*, as *T. testaceus*, Macq.; it is a *Pangonia*, apparently undescribed till now. Yellow. Antennæ bright yellow, the first two joints greyish, the first annulation of the third joint is wider than the second joint. Proboscis short and stout. Face darker in colour at base, with some black hairs. Beard white. Palpi red, bordered with short black hairs, long and curved, the same width throughout. Ocelli present. Thorax bordered on margin with yellow-orange hairs, as is the scutellum. Abdomen long, slightly darker in colour at the apex. Legs yellow, posterior femora with black pubescence. Wings hyaline, darker on fore border and at base, with a long appendix. Length 18–19 millim.

Hab. Brazil.

Pangonia fuscipennis, ♀, Wiedem., Auss. zweifl. Ins. i. p. 95 (1828); Macq., Dipt. Exot. i. p. 103 (1838).

Two females.

Antennæ with first annulation of the third joint wider than

the second joint, and the last joint nearly as long as the four preceding. Ocelli present. Wings have an appendix. The *Tabanus subvarius*, Walker, described by Walker as a variety of this species, is distinct (see below).

Hab. Brazil, Petropolis (*Clark*).

Pangonia subvaria, ♀, Walker, List Dipt. pt. i. p. 150 (1848), pt. v. Suppl. 1, p. 128 (1854). [*Tabanus subvarius*, Walker, *l. c.* pt. i. p. 150.]

This was incorrectly placed by Walker under *Tabanus* and described by him as *T. subvarius* in List Dipt. i. p. 150 (1848). Later in Cat. Dipt. pt. v. Suppl. 1, p. 128, he says it is a variety of *Pangonia fuscipennis*, Wiedem.; but it is a distinct species and should now stand as above. Walker's description may be enlarged as follows:—Antennæ with the first annulation of third joint wider than the second joint, and the last joint as long as the four preceding. Palpi curved and long, the same width throughout. Wings with an appendix.

Hab. Venezuela.

Pangonia umbra, ♀, Walker, Dipt. Saund. pt. i. p. 19 (1850).

This type is not a male as Walker says, but a female. The palpi are long and curved. Wings with an appendix. This rather resembles the preceding group of species, but as the antennæ are wanting it cannot be placed with them with certainty.

Hab. Chili.

Subgenus Erephrosis, Rond.

Wings with first posterior cell closed. *Eyes* hairy.

Erephrosis rufo-hirta, ♀, Walker, List Dipt. pt. i. p. 131 (1848).

The palpi are long and slender, extending but little beyond the projecting face, the two joints about equal in length. Wings with an appendix. This and the five following species are very similar in appearance and in the shape of the abdomen, which is large and convex.

Hab. Brazil (*Noel*).

Erephrosis piceo-hirta, ♀, Walker, List Dipt. pt. i. p. 132 (1848).

This type is a female, not a male as Walker says. Palpi as above. Wings with an appendix.

Hab. Brazil (*Mornay*).

Erephrosis nigro-hirta, ♀, Walker, List Dipt. pt. i. p. 131 (1848).

Palpi as above. Wings with appendix, one female has none.

Hab. Brazil (*Mornay*).

Erephrosis fulvithorax, Wiedem., Auss. zweifl. Ins. i. p. 89 (1828); Walker, List Dipt. pt. i. p. 132 (1848); see Will., Kansas Univ. Quart. iii. p. 189, for characters of male; O. Sacken, Cat. Dipt. N. Amer. (1878).

Sackenymia fulvithorax, Bigot, Ann. Soc. Ent. Fr. (5) ix. (1879).

One male and two females.

Palpi as above. Wings have no appendix. Bigot founded his genus *Sackenymia* for this species, but the bending backward at base of the external branch of the third longitudinal vein (his fourth), taken by him as distinctive for the genus, is not peculiar to it, but is common in *Pangonia*, Latr.

Hab. Brazil (*Mornay*, *Vigors*, *Noel*), Cuba.

Erephrosis badia, ♂, Walker, List Dipt. pt. i. p. 132 (1848).

The type is much denuded. Palpi short, club-shaped, ferruginous, clothed with black hairs. Abdomen reddish brown, clothed with black hairs. Pulvilli of tarsi yellow. Wings with an appendix.

Hab. Brazil (*Tucker*, *Noel*).

Erephrosis Besckii, ♀, Wiedem., Auss. zweifl. Ins. i. p. 97 (1828); Walker, List Dipt. pt. v. Suppl. 1, p. 125 (1854).

The second joint of the palpi is very long and slender, tapering. Wings with an appendix.

Hab. Brazil.

Erephrosis auripes, ♀, sp. n. (Pl. I. fig. 12.)

Dark brown. Antennæ dark red; first joint grey, clothed with long black hairs. Palpi red, the edges and tip black, the second joint very long and tapering. Frontal stripe covered with hoary pubescence on the posterior half near the antennæ; face with hoary pubescence. Beard white. Thorax covered with black pubescence and with black hairs on the anterior half of the lateral margins, then white, and a thick tuft of white hairs at base of wings extending to the scutellum; breast with white hairs on the sides, and black hairs in the centre. Abdomen black; tufts of white hairs on the posterior

lateral margins of second, fifth, and sixth segments, which also appear on the underside, becoming a faint band on the second segment. Legs black; underside of tarsi covered with orange pubescence, extending to the tibia on the anterior legs. Wings hyaline, faintly yellow on the fore border, brown at base, no appendix. Length 16, proboscis 13 millim.

Hab. Para (*Wallace* and *Bates*).

Erephrosis fulvitibialis, ♀, sp. n. (Pl. I. fig. 11.)

Brown. Antennæ reddish brown. Palpi black, long and slender; second joint equal in length to the first, broader at base, tapering to a point. Face with upper part covered with hoary pubescence. Beard white. Thorax chestnut-brown with some hoary pubescence, white hairs at base of wings. Abdomen shining; a tuft of white hairs on the lateral margins of second, fifth, and sixth segments, on the underside the white hairs become a faint band on the second segment. Legs brown; the tibiæ and the first joints of tarsi yellow, the posterior tibiæ and the tarsi are darker in colour. Wings hyaline, brown at base and on fore border, cross-veins slightly shadowed. Length 15, proboscis 8 millim.

Hab. Brazil (*Mornay*).

Erephrosis depressa, Macq., Dipt. Exot. i. p. 107 (1838); *l. c.* Suppl. iv. p. 25 (1850); Walker, List Dipt. pt. v. Suppl. 1, p. 126 (1854); Blanchard, Hist. fis. y polit. Chili, vii. p. 388 (1854); Schiner, Reise Novara, p. 120 (1866); Verh. zool.-bot. Gesell. Wien, xv. p. 712 (1865).

Pangonia crocata, Jænnicke, Ab. Senck. Gesell. vi. p. 330 (1868); van der Wulp, Tijd. Ent. xxiv. (2) p. 156 (1881).

Wulp says *crocata* is identical with this species. Wings with first posterior cell closed or nearly so; in one specimen it is open on the one wing and closed on the other. Wulp and Macquart both mention this discrepancy.

Hab. Valdivia, Chili (*Gay*); East Chili (*Darwin*).

Erephrosis rufo-aurea, Philippi, Verh. zool.-bot. Gesell. Wien, xv. p. 708 (1865).

One male and one female.

Hab. Chili.

Erephrosis sorbens, Wiedem., Auss. zweifl. Ins. i. p. 92 (1828).

The var. mentioned by Walker in List Dipt. pt. v. Suppl. 1, p. 323 (1854), is not to be identified.

Erephrosis leucopogon, Wiedem., Auss. zweifl. Ins. i. p. 92 (1828); Macq., Ann. Soc. Ent. Fr. vi. p. 429, pl. xv.; Walker, List Dipt. pt. v. Suppl. 1, p. 128 (1854).

Three females.
Hab. Brazil (*Noel*).

Erephrosis basalis, ♀, Walker, List Dipt. pt. i. p. 133 (1848).

The type is in very bad preservation. The palpi are long and slender.
Hab. Brazil (*Mornay*).

Erephrosis basalis, var., ♀, Walker, List Dipt. pt. v. Suppl. 1, p. 322 (1854).

This is most probably a distinct species, the palpi being quite different in shape from those of *basalis*, which are long and narrow; these have the second joint broad and concave, ending in a point, light red, with sides and tip black; the proboscis is much shorter and the wings clearer. Another female specimen, labelled in Walker's handwriting as *basalis*, resembles this variety, having the same palpi. The variety and the type are in too poor preservation to distinguish other differences between them.
Hab. R. Tapajos, Brazil, Amazons (*Bates*).

Erephrosis nana, ♂, Walker, Dipt. Saund. pt. i. p. 11 (1850).

In this species the first posterior cell is closed far from margin and more rounded than usual.
Hab. Brazil.

Erephrosis fumifera, ♀, Walker, List Dipt. pt. v. Suppl. 1, p. 324 (1854).

The palpi are long, the second joint broad at base, tapering to a point; wings with no appendix.
Hab. Santarem, Brazil (*Bates*).

Erephrosis Winthemi, Wiedem., Auss. zweifl. Ins. i. p. 91 (1828); Walker, List Dipt. pt. v. Suppl. 1, p. 127 (1854).

One female.
Hab. Brazil.

Erethrosis tenuistria, ♀, Walker, List Dipt. pt. i. p. 143 (1848).

The palpi have the second joint shorter than the first and club-shaped. Wings have no appendix.
Hab. Brazil (*Mornay*).

DIATOMINEURA, Rond.

Wings with first posterior cell open. *Eyes* hairy.

Diatomineura exeuns, ♀, Walker, Dipt. Saund. pt. i. p. 12 (1850).

The palpi in this species have a very short, broad, second joint, triangular and leaf-like in shape, concave in the middle. Wings have no appendix.

Hab. Brazil.

Diatomineura leucothorax, ♀, sp. n. (Pl. I. fig. 8.)

This was wrongly labelled *albithorax*, Macq., but it has no golden-yellow pubescence on the hind segments of abdomen. Black. Antennæ and palpi black; the first joint of the former clothed with long black hairs, longer than the second joint. Palpi are short; the second joint concave, broader at base, tapering to a point. The upper part of the face grey, clothed with black hairs; the frontal stripe the same colour, with black pubescence. Beard black. Proboscis short. The thorax and scutellum covered with dense greyish-white pubescence; the hairs on the posterior half are very long, the sides and breast clothed with black hairs. Abdomen wholly black, shining, with some black pubescence. Legs black; the femora clothed with long black hairs, the tibiæ of the posterior legs with whitish pubescence on the outside edge; pulvilli yellow. Wings hyaline. Halteres black. Length 12 millim.

Hab. Chili (*Edmonds*).

Diatomineura viridiventris, Macq., Dipt. Exot. i. p. 108 (1838); Blanchard, Hist. fis. y polit. Chile, vii. p. 389 (1854); Schiner, Reise der Novara, p. 99 (1866).

Three females.

Hab. Chili (*Edmonds*).

The *Pangonia ocellus* of Walker is not a *Pangonia* at all, but belongs to the Tabaninæ.

Europe.

PANGONIA, Latr.

PANGONIA, Rond.

**P. marginata*, Fabr. [*Tabanus haustellatus*, Fabr., Spec. Ins. ii. p. 4. 55 (1781); Fabr., Ent. Syst. iv. p. 562 (1794). *Tanyglossa haustellata*, Meig., Klass. i. p. 173 (1804); Meig., Syst. Beschr. ii. p. 24 (1838). *Pangonia cellulata*, Brullé, Exp. Mor., Zool. pl. 47. 1

(1832); Walker, *l. c.* pt. i. p. 133 (1848); id. *l. c.* pt. v. Suppl. 1, p. 118 (1854); Loew, Neue Dipt. Beiträge, vi. p. 23 (1853); Schiner, Cat. European Dipt. (1863).]—*Hab.* Algiers, S. Europe.

P. maculata, Fabr. [*Tabanus proboscideus*, Fabr., Ent. Syst. iv. p. 363 (1794). *Pangonia maculata*, Fabr., Syst. Antl. p. 90. 3 (1805); Latr., Gen. Crust. Ins. iv. p. 282, pl. xv. 4 (1806); Meig., Syst. Beschr. ii. p. 22. 2; Walker, *l. c.* pt. i. p. 134 (1848); Loew, *l. c.*; Schiner, Dipt. Austr. i. p. 44 (1863); id. Cat. (1863).]—*Hab.* Hungary.

**P. ferruginea*, Latr., *l. c.* p. 282. [*Tanyglossa ferruginea*, Meig., Klass. i. p. 175 (1804); id. Syst. Beschr. ii. p. 24 (1838); Loew, *l. c.*; Schiner, Cat.]—*Hab.* Portugal, Spain.

P. variegata, Macq., Hist. Nat. Ins. i. p. 195 (1835); Meig., Syst. Beschr. vii. p. 57; Loew, *l. c.*; Walker, *l. c.* pt. v. Suppl. 1, p. 119; Schiner, Cat.—*Hab.* S. Europe.

**P. micans*, Meig., *l. c.* ii. p. 25. [*P. ornata*, Meig., *l. c.* p. 26; Loew, *l. c.* p. 23; Walker, *l. c.* pt. i. p. 133; Schiner, Cat.]—*Hab.* S. Europe.

P. pyritosa, Loew, *l. c.* p. 27 (1853); Loew, Wien. ent. M. vi. p. 163 (1863).—*Hab.* Varna, Bulgaria; Brussa, Asia Minor.

P. fumida, Loew, *l. c.* p. 28; Schiner, Cat.—*Hab.* Andalusia.

P. affinis, Loew, *l. c.* p. 29; Schiner, Cat.—*Hab.* Spain.

P. griseipennis, Loew, *l. c.* p. 31; Schiner, Cat.—*Hab.* Spain.

P. dimidiata, Loew, *l. c.* p. 50; Schiner, Cat.—*Hab.* Andalusia.

**P. semiviridis*, ♂, sp. n.—*Hab.* Barengo, Spain.

Diatomineura, Rond.

D. aperta, Loew, *l. c.* p. 23; Schiner, Cat.—*Hab.* Portugal.

Subgenus Corizoneura, Rond.

C. annulata, Bigot, Mém. Soc. Zool. Fr. v. p. 612 (1892).—*Hab.* ? S. Europe.

Pangonia, Latr.

P. variegata, ♂, Fabr., Syst. Antl. p. 92. 8 (1805). [*Pangonia maculata*, Meig., *l. c.* ii. p. 22. 2; Loew, *l. c.* p. 25.]—*Hab.* S. Europe.

P. picta, Macq., *l. c.* p. 195; Meig., *l. c.* vii. p. 58; Walker, *l. c.* pt. v. Suppl. 1, p. 119 (1854); Loew, *l. c.* p. 32; Schiner, Cat.—*Hab.* S. Europe.

P. flava, Meig., *l. c.* ii. p. 22; Walker, *l. c.* p. 118; Loew, *l. c.* p. 22; Schiner, Cat.—*Hab.* S. France.

Pangonia, Latr.

Schiner, in his 'Catalogue of European Diptera' (1863), gives synonyms of *Pangonia maculata* and *marginata* and others, different from those that Loew gives in his 'Neue Dipt. Beiträge' (1853). I have followed the latter, who goes carefully into all the European species and should be consulted. Some of the species are also common to Asia.

Pangonia, Rond.

Wings with first posterior cell closed. *Eyes* naked.

Pangonia marginata, Fabr.

Tabanus haustellatus, Fabr., Spec. Ins. ii. p. 4. 55 (1781); id. Ent. Syst. iv. p. 562 (1794).
Tanyglossa haustellata, Meig., Klass. i. p. 173 (1804); id. Beschr. ii. p. 24 (1838).
Pangonia cellulata, Brullé. Exp. Mor., Zool. pl. xlvii. (1832); Walker, Cat. Dipt. pt. i. p. 133 (1848), pt. v. Suppl. 1, p. 118 (1854); Loew, Neue Beiträge, vi. p. 23 (1853); Schiner, Cat. European Diptera (1863).

Two females, one each of the two varieties mentioned by Loew. The wings have an appendix.
Hab. Albania, ? S. Europe.

Pangonia micans, Meig., Syst. Beschr. ii. p. 25 (1838).

Pangonia ornata, Meig., *l. c.*; Loew, Neue Dipt. Beiträge, vi. p. 23 (1853); Walker, List Dipt. pt. i. p. 133 (1848); Schiner, Cat. European Diptera (1863).

Four males and one female. The wings have an appendix.
Hab. S. France.

Pangonia ferruginea, Latr., Gen. Crust. Ins. iv. p. 282 (1806).

Tanyglossa ferruginea, Meig., Klass. i. p. 175 (1804); id. Syst. Beschr. ii. p. 24 (1838); Loew, Neue Dipt. Beiträge, vi. (1853); Schiner, Cat. (1863).

One male. The black stripe on the abdomen is not at all distinct. The wings have a short appendix.
Hab. Frejus, France.

Pangonia maculata, Fabr.

Tabanus proboscideus, Fabr., Ent. Syst. iv. p. 363 (1794).
Pangonia maculata, Fabr., Syst. Antl. p. 90. 3 (1805); Latr., Gen. Crust. Ins. iv. p. 282, pl. xv. (1806); Meig., Syst. Beschr. ii. p. 22. 2; Walker, List Dipt. pt. i. p. 134 (1848); Loew, Neue Dipt. Beiträge, vi. (1853); Schiner, Dipt. Austr. i. p. 44 (1862); Schiner, Cat. (1863).

One male. The wings have a short appendix.
Hab. France.

Pangonia semiviridis, ♂, sp. n. (Pl. I. fig. 7.)

Two males. Green. Face reddish, covered with yellow-grey tomentum, some yellow hairs at the sides. Beard light yellow. Antennæ and palpi bright red; the latter with the

two joints about equal in length, the second broader, tapering to a point. Proboscis short. Thorax and scutellum reddish, covered with dense orange-red pubescence, thicker at the sides. Abdomen: the first four segments on their posterior borders have a narrow dark band; the first segment has yellow-orange hairs on the sides; segments 2, 3, 4 with a tuft of black hairs on their anterior sides and yellow hair between these; segments 5 and 6 are wholly black, with black hairs at sides. Legs black: the anterior pair red, with the exception of the coxæ, which are black; the posterior pair are reddish brown with lighter knees. Wings reddish brown at base and on the fore border, with an appendix. Length 13–14 millim.

Hab. Barengo, Old Castile, from Saunders coll.

This well-marked species, resembling in general appearance *P. prasiniventris*, Macq., from S. America, does not seem to have been described before; it is labelled Saunders coll., 1868.

From unknown Localities.

Diatomineura, Rond.

D. limbithorax, Macq., *l. c.* Suppl. 5, p. 22.—*Hab.* —— ?

Pangonia, Latr.

P. inconspicua, Walker, *l. c.* pt. i. p. 136 (1848).—*Hab.* —— ?
P. hebes, Walker, *l. c.* p. 137.—*Hab.* —— ?

The last two Walker types are not to be identified in the Museum coll.

EXPLANATION OF PLATE I.

Fig. 1. *Pelecorhynchus Darwini*, ♀.
Fig. 2. —— *aurantiacus*, ♀.
Fig. 3. *Corizoneura pallidipennis*, ♀.
Fig. 4. *Diatomineura minima*, ♀.
Fig. 5. —— ——, ♂.
Fig. 6. *Pangonia flavescens*, ♀.
Fig. 6*a*. —— ——. Palpus.
Fig. 7. —— *semiviridis*, ♂.
Fig. 8. *Diatomineura leucothorax*, ♀.
Fig. 9. *Corizoneura umbratipennis*, ♀.
Fig. 10. *Erephrosis aureohirta*, ♀.
Fig. 11. —— *fulvitibialis*, ♀.
Fig. 12. —— *auripes*, ♀

[In the 'Annals' for January, page 119, line 10, *for* figs. 4 ♂, 5 ♀, *read* figs. 4 ♀, 5 ♂.]

XXI.—*On the Mating Instinct in Moths* *.

By Alfred Goldsborough Mayer.

During the past summer the author carried out a series of experiments to determine the nature of the mating instincts of *Collosamia promethia*.

A large number of cocoons of this moth were kindly collected for the author by W. L. Tower, Esq , in the neighbourhood of Cambridge, Massachusetts, and others were found by the writer at Maplewood, New Jersey. Altogether 449 cocoons were obtained during the winter of 1898–99. These were allowed to remain out of doors in Cambridge (Mass.), where they were exposed to the winter's cold, and then on May 5 they were taken to Loggerhead Key, one of the Dry Tortugas Islands, Florida.

This situation was most favourable for the prosecution of the experiments, for this insect does not extend south of the Carolinas, and thus the moths were separated many hundreds of miles from others of their species. Moreover, Loggerhead Key is a small sandy island surrounded by many miles of ocean, and thus no interference with the experiments could come from the outside.

The cocoons were hung under the shade of some trees, where they were protected from the direct rays of the sun. It was remarkable that all but five of the moths (three females and two males) issued from the cocoons during the early morning hours between sunrise and 11 o'clock.

The following table will show the rate at which the moths issued from their cocoons :—

Date.	Number of males.	Number of females.	Total.
May 18.....	1	2	3
19.....	1	2	3
20.....	1	2	3
21.....	1	0	1
22.....	1	0	1
23.....	0	0	0
24.....	1	0	1
25.....	1	1	2
26.....	0	0	0
27.....	1	1	2
28.....	0	0	0
Carried forward	8	8	16

* This paper was delivered as the Presidential Address before the Cambridge (Mass.) Entomological Society in January 1900, and published in 'Psyche,' the Journal of the Club, in February.

Date.	Number of males.	Number of females.	Total.
Brought forward....	8	8	16
May 29.....	2	1	3
30.....	0	1	1
31.....	0	0	0
June 1.....	5	2	7
2.....	6	2	8
3.....	3	3	6
4.....	2	3	5
5.....	4	1	5
6.....	3	2	5
7.....	3	3	6
8.....	1	1	2
9.....	6	1	7
10.....	13	3	16
11.....	10	1	11
12.....	7	3	10
13.....	5	3	8
14.....	10	2	12
15.....	8	5	13
16.....	2	9	11
17.....	3	3	6
18.....	4	1	5
19.....	2	1	3
20.....	2	1	3
21.....	1	1	2
22.....	1	2	3
23.....	0	0	0
24.....	0	1	1
25.....	0	0	0
26.....	0	0	0
27.....	0	1	1
Total.....	111	65	176

It will be seen that 63 per cent. of the moths were males and 37 per cent. were females.

As is well known, in this moth the wings of the female are reddish brown in colour, while in the male they are black; also the antennæ of the males are large and bushy and of the females small and slender.

The male possesses the ability to seek out the female even though she be at a considerable distance.

The males usually fly towards the females in the afternoon hours between 2 o'clock and sunset, and it is a common thing to observe several dozen males fluttering about the place where the female is resting.

In seeking the female the male flies up against the wind until he comes into her near presence; then he often flutters to and fro in a bungling manner that for want of better words we might designate as "stupid" and "aimless." Often he may fly into the immediate neighbourhood of the female, and

even then he will often flutter away without attempting to mate with her. At other times, however, he will fly at once to her and mate immediately.

After issuing from the cocoon the female generally remains quiescent for some hours, until she is fertilized, after which she flies actively about and deposits her eggs.

During her period of rest the female remains with wings closed over her back; but when a male moth, or indeed any large object, comes near her within range of her vision she slowly and majestically opens and closes her wings several times.

The males when resting act in a similar manner, but are by no means so sensitive as the females.

In captivity the moths lived from three to five days.

Observations and Experiments.

The first experiments were directed to determine whether the male was attracted by the sight of the female or whether he merely perceived an odour emanating from her.

Five females were placed in a clear glass battery-jar, having a wide open mouth; the mouth was covered with a coarse-meshed mosquito-netting, to allow a free circulation of air between the interior of the jar and the outside.

Five males were liberated about 100 feet away from the jar; they immediately flew to it and fluttered about the mouth.

The jar was then inverted (placed mouth downward) and sand packed around the open end, so as to prevent the air escaping from the interior.

Thus the females remained visible through the glass, but no scent could come from them. Under these circumstances all the males flew away at once and some disappeared from sight.

When, however, the jar was turned open end up again all the males reappeared, flying excitedly round the mouth.

This experiment was often repeated, and always with the same result. The males never pay the least attention to females which are enclosed in a hermetically sealed preserving-jar of clear glass.

Assuming that the males are able to see through glass which appears transparent to us, we may conclude that sight alone is not sufficient to attract the male toward the female, or even to retain him in her presence when he is within a few inches of her.

Another experiment, which seems to show that the male

depends solely upon scent in seeking the female, may be performed as follows:—A female is wrapped in loose raw cotton, so as to be invisible and yet allow a scent to emanate from her. The males then fly to the cotton and, crawling all over it, flutter their wings excitedly and grasp the cotton repeatedly with their abdominal claspers.

In another series of experiments, the females were enclosed in a wooden box having a paper chimney rising from one end, the other end being open and covered with mosquito-netting.

This box was so arranged that a current of air blew in through the open end and out of the chimney. The females were invisible from the outside, and yet any scent from them would be carried up the chimney into the outer air.

When the males were liberated they flew to the mouth of the chimney and fluttered about in its neighbourhood. None came to the large open end of the box, into which the air was blowing.

I then poured some CS_2 in a large, flat, evaporating-dish, and placed it near the open end of the box, in such a manner that the fumes passed up the chimney and mingled with the scent from the female moths. The males, however, paid no attention to the new odour, and still fluttered around the chimney; nor did they seem to be disturbed by the fumes of ethyl mercaptan, which possesses a most nauseating and putrid odour. Evidently the scent arising from the females is sufficient to overpower the fumes of CS_2 or ethyl mercaptan, if, indeed, the males have any perception of the latter odours.

The entire abdomens of five females were cut off and placed upon a table, while the males were placed in a large mosquito-net cage about 5 feet away. Two males were liberated within five minutes of the time when the abdomens were cut off. They both flew to the recently severed abdomens and paid no attention to the abdomenless females in an adjacent cage.

I repeated this experiment many times, but in all subsequent trials the males paid no attention either to the severed abdomens or to the mutilated females. So far as positive results go, however, it appears that the scent which attracts the males emanates from the abdomen of the females.

When the eggs are cut out of the female she no longer attracts the males, nor do the detached eggs attract them.

Dead or dying females have no attraction, nor do the males come to the empty cocoon from which a female has issued.

When a female remains for some time in any place she seems to impart an odour to the locality, for males will continue to come to it for about two hours after she has left.

It is interesting to notice that the females increase in attractiveness as they grow older. This was repeatedly demonstrated as follows:—

Several females, all of which were about six hours old, were confined in a large cage made of mosquito-netting, thus allowing a free circulation of air. The same number of females about thirty hours old were placed in another similar cage about six feet away from the younger females. Out of thirty-seven males thirty-five came exclusively to the cage containing the older females. Of the two remaining males one came to the younger females and one divided his attention between both cages. When the females are made to exchange cages the males will still go to the cage containing the older females.

Upon testing females thirty hours old against females fifty-five hours old, it appeared that they were equally attractive. Of seven males three came to the females thirty hours old, one divided his attention between both cages, and three came to the fifty-five hour females. It thus appears that females about six hours old are not so attractive as are females one or two days old.

Virgin females are somewhat more attractive than fertilized ones of the same age. When the virgins are placed in a cage five feet away from a cage containing an equal number of fertilized females the majority of the males fly to the virgins. Thus out of eleven males eight came to the virgin females, two to the fertilized ones, and one to both cages.

Fertilized females are still quite attractive to males, however, and the males will readily mate with them. This last was first observed by Miss Caroline G. Soule in 1894. She had two female *promethia* moths, each one of which was mated with four males and still remained attractive to other males. In fact, as long as the female remained alive and in good health she held attractions for the male.

One of my males mated four times with three females, and three others mated three times each. The males will make frantic efforts to mate with a female which is at the time coupling with another male.

The male will fly toward the female with normal eagerness even though his entire abdomen be cut off, and he will still seek the female when, in addition to this, the sides of his thorax are covered with impervious glue. It is therefore evident that the spiracles are not the seat of the organs by which the male perceives the female scent.

If, on the other hand, the antennæ of the male be covered with shellac, glue, paraffin, Canada balsam, celloidin, or

photographic paste *, he no longer seeks the female, and displays no excitement even though within an inch of her. In five instances I removed the paste by dissolving it in water, and in four of these cases the males readily mated with the females. Upon again covering the antennæ with the paste the males again failed to notice the females when in close proximity to them.

There can be but little doubt that the organs by which the male perceives the female are situated in the antennæ; indeed it has long been recognized that the olfactory organs of insects are found chiefly upon the antennæ. Hauser (1880) and Kraepelin (1883) have given excellent descriptions of the minute anatomy of these organs, Hauser having carried out an elaborate series of physiological experiments to determine their functions. He cut off the antennæ of several species of insects and found that their sense of smell was then either greatly impaired or totally lost; covering their antennæ with melted paraffin gave the same results.

Hauser also found that when the antennæ of the male (*Saturnia pavonia*) were removed the moth never makes any attempt to mate.

Packard (1898) gives an excellent review of all researches relating to the anatomy and physiology of the olfactory organs in insects.

If the eye of a male (*Callosamia promethia*) be covered thickly with pitch or Brunswick black †, so as to preclude the possibility of sight remaining, the male will still mate in a normal manner when placed near the female.

It will be remembered that in this moth the male is black while the female is reddish brown; in accordance with the well-known theory of Darwin, the peculiar coloration of the male might be due to sexual selection on the part of the female. We might suppose, indeed, that the female preferred dark-coloured males, and thus under the influence of sexual selection the males became darker and darker, until the present melanic colour has been attained.

In 1897 the author showed that the melanic colour of the male of this moth is phylogenetically newer than the colour-pattern of the female, and this fact, so far as it goes, lends support to this theory of Darwin's.

In order to test this hypothesis I cut off the wings of a number of females, leaving only short stumps, from which all

* The photographic paste mentioned was "Stafford's white paste"; probably any impervious paste would serve as well.

† This substance is commonly used as microscopic cement, and is of a pitchy consistency and a dense brown-black colour.

the scales were carefully brushed. Male wings were then neatly glued to the stumps, and thus the female presented the appearance of a male. Under these circumstances the males mated with the female quite as readily as they would have done under normal conditions.

I then tried the experiment of gluing female wings upon the male. Here again the mating seemed to occur with normal frequency, and I was unable to detect that the females displayed any unusual aversion toward their effeminate-looking consorts.

It is also interesting to note that normal males pay no attention to males with female wings.

In another series of experiments the wings were cut entirely off of males and females and the scales brushed off of their bodies; and yet these shabby males were readily accepted by normal females, nor could I see that normal males displayed any aversion to mating with wingless females.

We are therefore forced to conclude that the melanic coloration of the male has not been brought about through the agency of sexual selection on the part of the female. In this connexion it is interesting to notice that Plateau (1897) concludes that insects are attracted only by the odours of flowers, and not at all by their colour.

In conclusion, it gives me great pleasure to express my gratitude to Miss Caroline G. Soule for advice and aid; to W. L. Tower, Esq., for his kindness in collecting many cocoons of the moth; and to Dr. Robert W. Fuller, who provided me with the reagents used in the manufacture of ethyl mercaptan.

Summary of Conclusions.

The male is positively chemotactic toward some substance which emanates from the abdomen of the female, and which he perceives through olfactory organs situated upon his antennæ.

Females thirty to sixty hours old are much more attractive to males than are young females five to ten hours old.

Virgin females are somewhat more attractive than are fertilized ones of the same age.

The male will mate at least four times either with the same or with different females.

Neither males nor females pay any attention to the appearance of their partners.

The melanic colour of the male has not been brought about by sexual selection on the part of the female.

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XXII.—*On British Species of* Siphonostoma.

By M. I. Newbigin, D.Sc. (Lond.).

[Plate IV.]

The two most familiar species of *Siphonostoma* (*Flabellifera*) are *S. affinis*, the typical northern form, and *S. diplochaïtos*, the typical Mediterranean form. It is, however, worthy of notice that while Cunningham and Ramage * suggest that the two are identical, St. Joseph † says there can be no possibility of confusion between the two. In the vicinity of Millport Marine Station a species of *Siphonostoma* occurs in great abundance in the nests of *Lima hians*, and a collection made there during this summer has enabled me to make some observations on the specific characters. For purposes of comparison, Mr. E. J. Allen, of the Plymouth Marine Station, kindly furnished me with twenty-one specimens of the species found in the neighbourhood of Plymouth. The two forms are distinct, the Millport specimens agreeing most closely with *S. diplochaïtos*, Otto, the Plymouth specimens with *S. affinis*, Sars, as defined by St. Joseph. Before proceeding to describe the specimens, it may be well to give in tabular form St. Joseph's list of the specific differences between the two:—

* "Polychæta Sedentaria of the Firth of Forth," Trans. Roy. Soc. Edin. xxxiii. (1888), p. 677.

† "Annélides Polychètes des Côtes de Dinard," Ann. Sci. Nat. (Zool.) xvii. (1894) p. 96.

S. affinis (specimens from Dinard).	*S. diplochaïtos* (Naples specimens).
Length 20–40 millim.	Length 70–80 millim.
Breadth 2–3 millim.	Breadth 7 millim.
Segments 30–47.	Segments 39–40.
Gills 40–50.	Gills 80–100.
Cephalic bristles 60–80.	Cephalic bristles 200 or more.
Notopodial bristles 4–5.	Notopodial bristles 12–14.
Neuropodium with 1–2 hooks and 6 simple bristles.	Neuropodium with 4–5 hooks and 6 simple bristles.

Thus, apart from size, the differences chiefly consist in the disparity in numbers of the various appendages. These distinctions are somewhat vitiated by the fact that St. Joseph is inclined to regard *Chloræma Dujardinii*, Qfg., as the young of *S. affinis*, and it differs in the diminished number of segments, gills, and cephalic bristles. It is obvious that if in *S. affinis* these structures increase in number throughout life, they may also do the same in *S. diplochaïtos*, and the young stages of the latter may thus resemble the adults of *S. affinis*. In fact this is precisely what the Millport specimens show. St. Joseph, however, further seeks to differentiate the two species by the minute characters of the bristles, and states that these are of much importance in distinguishing the species in the genus. The special points upon which he relies are the following :—

In *S. affinis* the distance between the successive annuli of the cephalic bristles is 0·025 millim. The hooks have the following structure: immediately below the hooked region there are 86 annuli, the intervening spaces gradually increasing, but never exceeding 0·02 millim.; there is then a long gap of 0·1 millim. in length, followed by 10–20 annuli separated by spaces of about 0·02 millim.

In *S. diplochaïtos* the distance between the successive rings of the cephalic bristles is only 0·0168 millim. In the hooks the hooked region is less curved; it is followed by 50–60 annuli placed very close together, then by 4 annuli separated by distances of 0·048 millim., finally by 50 closely aggregated annuli.

As to my own observations, the Plymouth specimens agreed very closely with St. Joseph's description of *S. affinis*. The length varied from 15–25 millim., with a usual breadth of 2 millim. The number of segments varied from 39–45, and there were about 40 gills. In regard to the cephalic bristles, there were some slight differences; usually numbering about 80, in one case at least a very careful count gave over 100, though some of these were short and small. As to the

distance between the annuli, the specimens did not display the constancy indicated by St. Joseph's descriptions of Dinard specimens. Not only was there variation in the different bristles of the same worm, but the same bristle often gave varying figures for its different annuli. The following are some typical measurements:—0·021 millim., 0·034 millim., 0·036 millim., 0·039 millim., 0·057 millim. The dorsal bristles usually numbered 5–6 instead of 4–5, and not infrequently in addition there were one or two small bristles embedded in the substance of the papilla and not projecting from its surface. There was a wide range of variation in regard to the distance of the annuli apart (see Pl. IV. fig. 5). The total length of the bristles varied slightly in the different specimens; the longest was usually 1·6 millim. to 1·2 millim. in length; this agrees very closely with St. Joseph's description for the Dinard specimens. In regard to the ventral hooks and their associated simple bristles, the specimens agreed closely with St. Joseph's description, but the minute characters of the hooks did not entirely agree with his account (see fig. 6).

In general the Plymouth specimens, though agreeing very closely with St. Joseph's Dinard specimens, showed variation in three points:—(1) the number of cephalic bristles, (2) the number of notopodial bristles in the other regions of the body, (3) the minute structure of the bristles. All three are characters which, according to St. Joseph, enter into the definition of the species.

The Millport specimens of *Siphonostoma* showed a great variation in size, some reaching a length of 70 millim., with a breadth of 7 millim., and others being only 25 millim., with a breadth of 3 millim. All were taken in the same locality (neighbourhood of Tan Buoy), and all from the interior of *Lima* nests. As large and small specimens occur together in the same nest, it seems legitimate to conclude that the latter are merely young stages of the former.

The large specimens—those of 60–70 millim. in length—are readily distinguished from the Plymouth species. As obvious distinguishing features we have not only the length of the body and the breadth of the anterior region, but the more distinct tapering of the posterior region and the large size of the notopodial bristles, which project in a very conspicuous way. Specimens of 25 millim. in length, on the other hand, show a much greater resemblance to the Plymouth form. We shall consider separately the characters of the large and small specimens, but it should be noted that specimens

of intermediate length are intermediate in character between the two.

Specimens of 60–70 millim. in length had 40–45 segments. This does not agree with St. Joseph's statement for *S. diplochaïtos*, but Bles *, in speaking of this species (Naples specimens) says 40–50 segments, so that there must obviously be variation in this respect. The gills in these full-grown specimens numbered about 100, the cephalic bristles 200 or more; but in the structure of notopodium and neuropodium they showed less close agreement with St. Joseph's specimens. The notopodium bore usually 10–12 long annulated bristles, but in addition there were about 10–13 other short bristles buried in the substance of the papilla, and hardly, if at all, visible externally (see Pl. IV. fig. 1). The distance of the annuli apart varied from 0·026 millim. to 0 071 millim. in the cephalic bristles, and from 0·0079 millim. to 0 023 millim. in the other notopodial bristles (see fig. 3). The range of variation in this respect is thus very wide. As to the hooks of the neuropodium, these did not exceed 3 in number (in place of 4–5), and in many instances 1 or 2 only were present; but it may be noticed that the hooks fall out very readily. The annulation was often indistinct throughout a portion at least of the hook (see fig. 4), and in no case did I succeed in finding any one hook which displayed all the characters described by St. Joseph. He describes his specimens of *S. diplochaïtos* as having less distinctly recurved hooks than those of *S. affinis*; but my specimens showed no such distinction. Embedded in the neuropodial papillæ and surrounding the base of the hooks there are, as in *S. affinis*, short annulated bristles whose slender tips only project from the surface of the papilla (see fig. 2). In the Millport specimens instead of 6 of these there were usually about 13: of these about 7 actually projected from the papilla; the other 6, though identical in structure, lay entirely within the substance of the papilla (see fig. 2). It seems impossible to doubt the identity of these Millport specimens with *Siphonostoma diplochaïtos* of the Mediterranean; but they differ especially in the diminished number of ventral hooks and in the presence of small bristles in the notopodial papilla, in addition to the typical number.

The small Millport specimens differed in several respects from the large. Specimens of 25 millim. in length had 34–35 segments, but one of 38 millim. had 43 segments. In specimens of 25–40 millim. the number of cephalic bristles

* Brit. Assoc. Report, 1891.

varied from 140–150, as contrasted with over 200 in the adult; the number of gills varied from 60–80, as compared with about 100 in the adult. The distance of the annuli apart varied from 0·0158–0·0342 millim. in the cephalic bristles. The notopodial papillæ bore usually 6 long projecting bristles (cf. *S. affinis*), but there were 8–9 small additional bristles buried in the substance of the papilla. These small bristles are not visible except after careful search, and under a low power the general aspect of the papilla closely resembles that of *S. affinis*. The only constant difference which I could find lies in the fact that, in specimens of the two species of the same body-length, the dorsal bristles of *S. diplochaïtos* are longer than those of *S. affinis*. Thus in specimens about 25 millim. long those of the latter species are 1·6–1·2 millim. long, those of the former 2·16–2·37 millim.

The small specimens of *S. diplochaïtos* displayed on their neuropodial papillæ 1–2 hooks whose bases were surrounded by 6 simple bristles. The hooks did not agree closely in their minute characters with those of St. Joseph's specimens.

This description shows that *S. diplochaïtos* changes in character during growth, the changes occurring in those special characters which serve to differentiate the adult from *S. affinis*. Thus the young as compared with the adult show a diminished number of segments, gills, cephalic bristles, ordinary notopodial bristles, and neuropodial hooks; and it is precisely the numbers of these structures which constitute the distinguishing marks of the species. In other words, the young *S. diplochaïtos* approximates in character to the adult *S. affinis*. The present observations do not support St. Joseph's suggestion that the minute characters of the bristles are of specific importance. In view of the approximation of the young *S. diplochaïtos* to the characters of the adult *S. affinis*, it must be doubtful how far the two are entitled to rank as separate species.

It may seem remarkable that the Plymouth specimens of *S. affinis* should agree so closely with St. Joseph's descriptions, while the Millport specimens should differ so markedly from his descriptions of *S. diplochaïtos*; but it is to be noticed that in the case of *S. affinis* the two sets of specimens are both Channel forms, while the specimens of *S. diplochaïtos* come from such widely separated localities as the Bay of Naples and the Firth of Clyde.

It is interesting to note that St. Joseph describes from Saint-Jean-de-Luz * a new *Siphonostoma* under the name of

* "Annélides Polychètes des Côtes de France," Ann. Sci. Nat. (Zool.) v. (1897) p. 363.

Flabelligera Claparedii, which differs from *S. diplochaïtos* chiefly in having 23–25 notopodial bristles, 1–2 ventral hooks, and different forms of papillæ. Now if in the Millport specimens the short notopodial bristles be counted in addition to the long ones, this would make the number the same as in St. Joseph's species, and the number of ventral hooks is the same. It seems probable that *S. diplochaïtos* is a very variable species, exhibiting a strong tendency to run into local races, and that the three "species," *S. diplochaïtos*, *S. affinis*, and *S. Claparedii*, are only varieties of the same species.

EXPLANATION OF PLATE IV.

Fig. 1. Cluster of bristles from one of the posterior notopodia of *S. diplochaïtos*, showing eleven long bristles, represented as if cut short, and ten short bristles scarcely projecting from the surface of the papilla. The line *a a* represents the outline of the papilla. × 50.

Fig. 2. Neuropodial papilla of *S. diplochaïtos* with hooks removed, to show the short simple bristles, here twelve in number. × 50.

Fig. 3. Fragment of dorsal bristle of *S. diplochaïtos*, to show the varying distances at which the annuli are placed. × 300.

Fig. 4. Hook of *S. diplochaïtos*, to show annuli. In the median region no annuli could be seen even with a high magnification. × 40.

Fig. 5. Fragment of dorsal bristle of *S. affinis*, to show annuli. × 300.

Fig. 6. Hook of *S. affinis*, to show annuli. × 90.

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XXIII.—*On an Unnamed Species of* Cervus *from Turkestan*.

By R. Lydekker.

On pages 108 and 109 of my work entitled 'The Deer of All Lands' brief mention is made of a stag recently (and perhaps still) living in the zoological gardens at Moscow, which at the time in question I was unable to refer to any known species, though I refrained from giving it a scientific name till further information was obtained. The specimen, of which a figure, copied from a photograph, was given, was reputed to have come from Turkestan, and in the characters of its antlers, of which a cast pair are in the possession of the Duke of Bedford, is evidently allied to the shou (*Cervus affinis*) of the district north of Bhutan.

Recently the Duke of Bedford has received a stag from the neighbourhood of Tashkend, which is now living in the park at Woburn Abbey, and which, although it has at present no antlers, I have no hesitation in referring to the same species

as the Moscow specimen. Its resemblance to the latter is especially shown by the remarkably short and thick neck, as well as by the pelage being ashy grey at all seasons. Assuming this reference to be correct, we have the reputed place of origin of the Moscow specimen confirmed, and thus evidence that a shou-like deer inhabits the Turkestan district, part of which was included in the old kingdom of Bactria.

Although our information with regard to the shou is very imperfect, yet it appears to have tawny-coloured hair during at least a portion of the year, and its antlers have five tines, whereas those of the Moscow specimen have normally but four, owing to the absence of the bez-tine *. Apart from this, it is altogether unlikely that the range of the shou should extend from the neighbourhood of Bhutan to Turkestan, especially since it is unknown in the intermediate area.

Accordingly all the evidence seems to point to the specific (or subspecific) distinctness of the Turkestan deer, which I propose to call *Cervus bactrianus*, the pair of shed antlers at Woburn Abbey forming the type.

The species may be defined as allied in the general form of its antlers to *C. affinis*, but the size apparently smaller, the colour of the coat ashy grey at all seasons, and the antlers normally with but four tines on each side, the bez-tine being missing. Another feature is the shortness and breadth of the e ad and neck.

When the Tashkend specimen at Woburn develops its new antlers, I hope to give a further notice of the species.

XXIV.—*British Amphipoda: Fam.* Lysianassidæ (*concluded*).

By Canon Norman, M.A., D.C.L., LL.D., F.R.S., &c.

[Plate VI.]

Fam. II. Lysianassidæ (continued from p. 144).

Genus 7. Sophrosyne, Stebbing.

(Report 'Challenger' Amphipoda, p. 652.)

25. *Sophrosyne Robertsoni*, Stebbing & Robertson.

1890. *Sophrosyne Robertsoni*, Stebbing & Robertson, "Four new British Amphipoda," Trans. Linn. Soc. vol. xiii. p. 31, pl. v. A.

Hab. The Clyde (*D. R.*); Upper Loch Fyne (*J. Murray*); Loch Fyne (*T. S.*).

* In the pair at Woburn there are five tines on the left side, apparently due to abnormal development, the terminal fork being smaller on this side than on the other.

Distrib. 'Porcupine,' 1869, St. 36, lat. 48° 50′ N., long. 11° 9′ W., *i. e.* outside the entrance to the English Channel, in 725 fathoms: *Mus. Nor.*

[Genus 8. Cyclocaris, Stebbing.

(Report 'Challenger' Crustacea, p. 664.)

[*Cyclocaris faroensis*, sp. n. (Pl. VI. figs. 5–15.)

The form of the head, the general character of the antennæ, of the gnathopods and peræopods, of all the coxæ, of the dorsal impression of the first segment of the urosome, and of uropods and telson show remarkable resemblance to *Cyclocaris tahitensis*, Stebbing, the type and only previously known species of a very marked genus. So remarkable is the resemblance, that the differences seem scarcely varietal; but I hesitate to unite a form found in the Faroe Channel with one from so distant a locality as Tahiti.

The *cephalon* has a similar concavity between the bases of the two pairs of antennæ as in *C. tahitensis*, and similarly leaves the base of the lower pair fully exposed to view.

The *upper antennæ* or antennules have the peduncle shorter than the cephalon; the flagellum twelve-jointed, the first of these joints is fully as long as the cephalon, the distal lower corner of this and of the four following joints is furnished with long slender spines: the secondary appendage is composed of six articulations, of which the first is the longest; it reaches to the seventh joint of the flagellum.

The *lower antennæ* have the peduncle short, the last two joints of the peduncle subequal, and the flagellum consists of twenty-two articulations.

No *eyes* are visible. The remarkable *mandible* (fig. 5) closely corresponds with that of the type species.

The *first maxillæ* (fig. 6) have the basal lobe narrowed almost to a point below, whence it swells out into a nearly semicircular form, furnished on the inner margin with short stiff setæ, which are verticillately plumed; the masticatory lobe is elongated and narrowed to the extremity, furnished with long flexuous spines, bearing a tooth on the side, and also with slender setæ: the palp is narrow, the last joint arcuate, and terminating in three teeth tipped with spine-points; of these the central is the longest; outside these at the outer corner is a small short spine and a small seta, and on the hinder margin another and larger seta.

The *second maxillæ* (fig. 7) have the outer lobe much longer than the inner, the latter is margined with two distinct

rows of setæ; the setæ in one of these rows are verticillately plumose, in the other simply plumose.

The basal lobe of the *maxilliped* (fig. 8) widens distally and the extremity is rather oblique and flexuous; a row of setæ is situated on the middle of the lobe; the masticatory lobe is remarkable for its great breadth and widely rounded extremity, the inner margin is faintly crenulated, the outer and distal margins are set round with simple setæ at nearly equal intervals; the palp is stout, its terminal nail strong, the antepenultimate joint just overtops the masticatory lobe.

The *gnathopods* have the coxæ small and almost entirely concealed by the overlying coxa of the first peræopod. Both pairs of gnathopods (figs. 9 & 10) closely resemble those of *C. tahitensis*, but the first pair are much more stoutly built than in that species.

The *peræopods* with their coxæ (figs. 11 & 12, coxæ of second and third pair) are in close agreement with those of the type. A comparison of fig. 13 of the last peræopod with Stebbing's figure of the same limb in *C. tahitensis* shows the remarkable resemblance, seen even in the hinder margin of the basos, which in the lower portion is slightly concave and devoid of the serrations which are present in the upper portion of the margin.

The *third segment* of the metasome has the hinder corner of the epimera slightly produced and pointed (fig. 14).

The first segment of the *urosome* has a dorsal sinus. The second uropods are longer than the first, but do not reach to more than half the length of the rami of the largely developed last pair, which have their rami fully twice as long as their peduncle: the outer branch is two-jointed; its inner margin bears four or five small spinules, and under a high power the margin itself is seen to be delicately serrulated. The *telson* (fig. 15) is narrow, very long and produced, and cleft almost to the base; it extends beyond the extremities of the first and second uropods.

Length 19 millim.

Two specimens taken by Sir John Murray in the 'Triton' Expedition of 1882, Stat. 8, Faroe Channel, lat. 60° 18′ N., long. 6° 15′ W., in 640 fathoms, temperature 30° Fahr.

The features which distinguish this species from the type are chiefly the more robust character of the first gnathopods and the form of the hinder margin of the third segment of the metasome.]